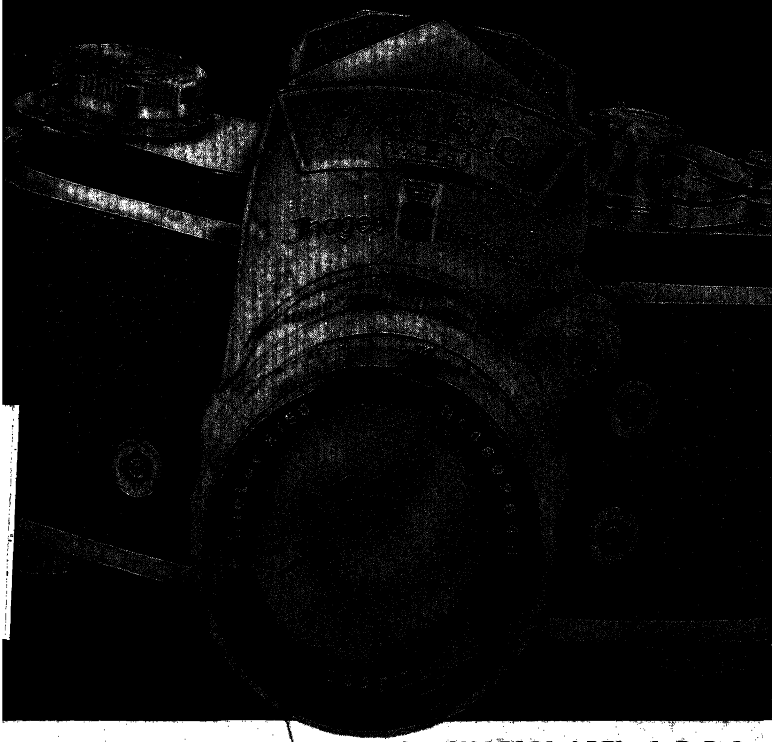
EXAKTA



WITH SPECIAL
COLOR SECTION

by CHARLES ABEL, A.R.P.S.
and
KENNETH S. TYDINGS, S.P.E

The
EXAKTA GUIDE

MISSOURI STATE LIBRARY
JEFFERSON CITY, MISSOURI

by

KENNETH S. TYDINGS, *S.P.E.*
Photographic Consultant and Inventor.

and

CHARLES ABEL, *Hon. M. Photog., A.R.P.S.*
Editor and Publisher The Professional Photographer; *from 1933 to 1949 Executive Manager The Photographers' Association of America; Trustee for Life of the Winona School of Photography*

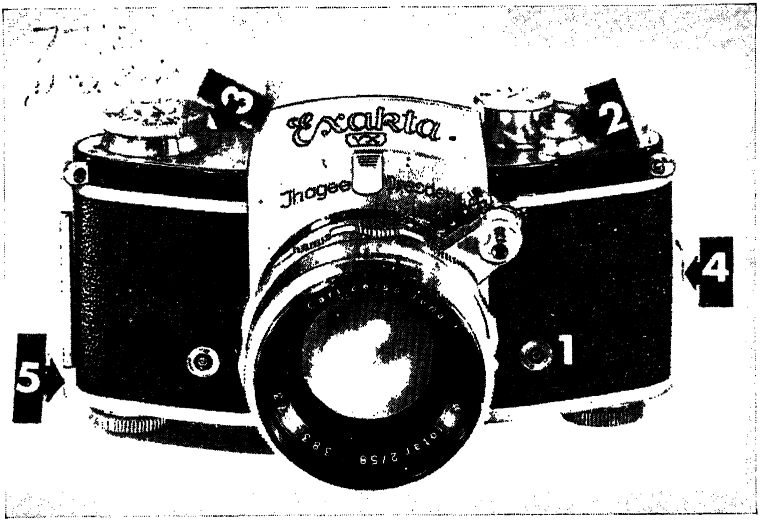
New York
GREENBERG : PUBLISHER

12TH PRINTING, NOVEMBER 1957

© 1951, 1956, by Greenberg : Publisher, a corporation. Published in New York by Greenberg : Publisher, and simultaneously in Toronto, Canada, by Ambassador Books, Ltd. All Rights Reserved under International and Pan American Copyright Conventions. Printed in U.S.A.
Library of Congress Catalog Card Number: 55–12254

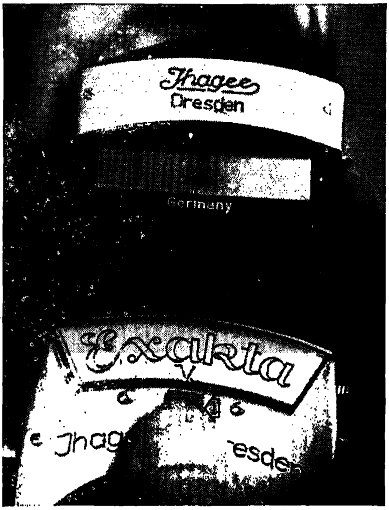
CONTENTS

1. The Camera 4
2. Loading and Unloading the Camera 9
3. What Film to Use 14
4. Holding and Focusing the Camera 19
5. Taking the Picture 25
6. Sharpness by Hyperfocal Distance, Depth of Field and Pin-point Focus 31
7. Setting Up an Outdoor Exposure 37
8. Indoor Lighting with Flash 44
9. Floodlighted Indoor Pictures 50
10. Making Pictures in Full Color 53
11. Light—and I–G–A–S Formula 57
12. Processing the Negative 63
13. Printing and Enlarging (Processing the Negative) 68
14. After Treatment of Prints 73
15. Composition and Interpretation 76
16. Filters—the Colormasters of Light 79
17. Wide-Angle and Telephoto Lenses 82
18. Available Light—Bounce Light 88
Making the most of color information
19. Sports and Action Shots 91
20. Children and Pets 96
21. Portraiture 99
22. Close-Ups, Copying, Microfilming, and Photomacrograpny 105
23. Photomicrography—Magnifying Images 25x and Up 112
24. Stereoscopic Photography 115
25. Photography in Medicine and Science 121
26. Accessories for the Exakta 126



ADVANCED FEATURES OF THE EXAKTA AUTOMATIC XV

1. Single button Flash attachment using the standard PC cord.
2. Positive Exposure Counter Setting Button
3. Film Speed Indicator
4. Positive Back Latch to prevent accidental opening
5. Removeable hinge for separating the back.



EXCHANGING THE EXAKTA PENTA PRISM

1. The engaging latch is pressed downward
2. The Penta Prism is lifted gently.

The waist-level finder is also removed by releasing the engaging latch and then lifting the finder out of the camera.

The Modern Exakta cameras are truly an answer to the wishful thinking of most photographers because of their admirable combination of technical design, versatility, exterior contour, and of course their unmatched performance. Beginners, advanced amateurs as well as professionals always can find a 35mm outfit a welcome adjunct to their equipment. The Exaktas as a group, are of the single reflex type. By this we mean that focusing and composing the picture is accomplished through the same lens which ultimately takes the picture. This differs from the other two systems which either use a combined viewfinder and rangefinder or an entirely separate lens system as in the case of twin lens reflex cameras. In Exakta photography, the rays of light passing through the lens are first intercepted by a movable mirror before they reach the film, then are reflected to a ground glass viewing screen at the top of the camera where the image can be focused for sharpness. There you see the picture, up to the moment of making the exposure, exactly the same size and the same position as it will eventually appear on your negative. The image will be right side up but reversed from left to right if the waist level finder is used. It will be correctly orientated when the pentaprism replaces the waist level finder. You are probably wondering what is a penta prism? There will be more about this later on.

The actual mechanics of picture taking with a single lens reflex may be divided into two related and almost simultaneously synchronized actions. The pressing of the shutter release activates a mechanism which swings the mirror up and out of the way of the image forming rays of light. The mirror plate then is directly below the ground glass, sealing it off and making the camera light-tight. Only then does the focal plane shutter (somewhat similar to a roller type window shade with a slit in it) travel across the back of the camera to expose the film. The size of the open slit in the shutter determines the exposure because the shutter mechanism always moves at a constant speed.

Time Parallax—Shutter and Iris Operate Simultaneously

Shutter: The Exaktas single lens system operates so swiftly that there is no important time delay while the mirror swings out of the way. The release mechanism and the mirror are so finely integrated that the pressure of the button swings the mirror out of the way before the button has completed its movement.

Iris: Focusing through the lens itself is best performed when the most available light reaches the ground glass. This, naturally, occurs when the lens is wide open. However, many exposures must be made with the lens opening narrowed from the widest aperture.

The Automatic Exakta VX eliminates this time parallax problem because the motion of engaging the shutter release automatically narrows the lens aperture at the same time. The complete elimination of time parallax makes the Automatic Exakta VX an ideal camera.

The pre-set iris was the first historical step in reducing iris time parallax. You pre-selected the iris opening with this system, and preset for focusing was with the lens wide open. Then you were able to turn the pre-set ring and narrow the opening to the pre-selected f/ stop without again looking at the f/ numbers.

In doing so the iris ring has to be turned gently; otherwise the lens focus might be changed.

The automatic pre-set diaphragm, the latest step, answered these problems by automatically narrowing the lens opening as the release button is pressed so that a change of focus is impossible, and by reopening the iris to its widest opening immediately after the exposure is made and the exposure button released.

The automatic pre-set diaphragm has freed single reflex photography of its previous limitations.

Accessories

The Exaktas can be used with a wide range of accessories. Properly selected accessories, however, enable you to take what would otherwise be considered impossible pictures. The last chapter in the book describes and explains only those accessories which have the greatest general value and immediate application. With this advice, you may purchase one accessory at a time, evaluate it in terms of your own needs, and then purchase others to complete the Exakta system.

In brief, all Exakta models are compact and capable of rapid manipulation. All are fitted with interchangeable lenses and are a pleasure to use because of the facility with which lens and shutter combinations may be changed by easily located knobs, and the combined film advance and shutter wind. All are notable for their remarkable range of 29 shutter speeds,—from $1/1000$ to 12 seconds. However, before launching into a description of the various models, a word must be said about official equipment.

Official Equipment and Registration

Each new Exakta comes with a registration card and import certificate. This is your guarantee that the camera is genuine, brand new, and reliable. So much so that filing your registration card with the Exakta Camera Company, 765 Bronx River Road, Bronxville, New York, is similar to an insurance policy. The registration card and import certificate tell you:

1. The camera is genuine and that the original factory lens is in the camera.
2. The camera is guaranteed so that you can make your claims to the company.
3. You are buying the current model—it is new—spanking fresh.
4. It is a legal camera in that government duty has been paid for it.
5. Free literature will be sent to you and you can make technical inquiries at any time.

Official IHAGEE Equipment

Official Ihagee equipment should be used whenever and wherever possible. The manufacturer of the Exakta, the Ihagee Company, knows the tolerances to which the camera has been made. They are qualified to make accessory equipment on this basis, because they know what is needed to make their camera function most efficiently. The manufacturer's name on any equipment becomes your insurance for better pictures because you will then know that if the manufacturer makes an accessory for his camera he takes great pains to be certain that it will work correctly.

Exakta Models

The Exakta cameras have undergone improvements through the years which have made them more reliable in use, easier to use, and more versatile. The Exakta I and Exakta II models are the best in their field, but the single lens reflex burst its bounds when the Exakta V, the Exakta VX, the Automatic VX, were introduced. These later models, besides the interchangeable lens features, through the lens focusing and synchronization both for flashtubes (speedlights) and flashlamps provided three basic types of viewing methods which were revolutionary in scope.

1. The waist level finder contains a magnifying glass built as an integral part of the ground glass. This is the standard viewfinder. It is interchangeable with:

2. The Exakta Pentaprism. The name Exakta again is mentioned to insure your purchase of a pentaprism that was specifically designed by Carl Zeiss for the Exakta. The interchangeable pentaprism must be accurate because a difference of newspaper thickness can mean the difference between a sharp and an unsharp picture. The pentaprism was the first revolutionary idea that brought the Exaktas to the head of the parade in that it permitted eye-level focusing and viewfinding. It eliminated waist level finding which caused you to look down into the camera. The pentaprism enabled you to hold the camera and your head in the normal manner—straight ahead.

3. The Rangefinder pentaprism is the last word in viewfinding equipment for the Exakta because the rangefinder prisms that replace the regular ground glass of the pentaprism tell you when you are in or out of focus by the linear appearance of the image. Some camera owners may have difficulty distinguishing the critical point of focus on the ground glass. The rangefinder prisms give you accuracy because straight lines are continuous when in-focus and are disconnected when out-of-focus.

The Exakta I and Exakta II did not have a removable and interchangeable waist level finder, so that the regular pentaprism or penta rangefinder prism cannot be used with them. A clip-on pentaprism was designed for these models. There, however, is one other camera made by Ihagee which has an interchangeable viewfinding system—the Exa.

The Exa is the smallest single lens reflex in the Ihagee line. While the viewfinding system is similar to the Exakta, its shutter speeds are 1/25, 1/50, 1/100, 1/150 second. It has separate contacts for standard speedlight and flash units. The shutter differs from that of the Exakta in that it is formed as part of the reflecting mirror so that there is no time lag (time parallax) in making the exposure. The shutter traveling with the mirror moves down to up on the short vertical side of the film frame. The Exa never was designed to replace the Exakta and will only take lenses up to 105 mm focal length. It is a wonderful camera for color and its compactness makes it an ideal camera for clinical photography.

The VX

Although there are considerable numbers of Exakta I, II and V's in use, these older models are no longer in the process of manufacture or assembly. The only current model being produced is the Exakta VX.

In the VX a number of significant changes have been made:

1. A film type indicator has been added. It is located just below the slow speed and delayed action knob. This tells you what type of film is loaded in the camera.

2. The back is pin-hinged so that it is always kept in place. The previous Exakta models had a completely removable back. With the VX a pin keeps the back hinged or the pin may be removed so that the back can be completely separated from the main camera body.

3. The take-up spool may be replaced by a regular 35mm magazine. If this is done, you can wind your film directly onto another cartridge and eliminate the rewinding procedure. The less film handling that occurs, the less chance there is for mechanical scratching by any part of the camera that may come in contact with the film.

4. There is a knob on the bottom of the camera that must be pulled down to open the camera back. This makes the back more secure and it eliminates any chance of light leaking into the camera. The better closure also prevents the back from ever springing open.

5. The VX's standard lenses now have a pre-selected aperture which, while it is manually operated, speeds up the aperture changing procedure and lessens any chance for error.

6. The body is die cast by a new method which allows the maintenance of the finest tolerances possible in addition to increasing the general over-all ruggedness of the whole assembly.

These refinements contribute to the versatility and the operational simplicity of the VX. Otherwise, the regular picture taking methods. the interchangeability of lens, etc., remain the same as with the other 35mm Exaktas.

CHAPTER 2 / LOADING AND UNLOADING THE CAMERA

The operation of placing a roll of film in a camera and winding it into place so that it is ready for use is known as "loading." All models of the Exakta are simple enough in this respect, but to avoid ruining the film by having it light-struck and spoiled before you are ready to expose it in the correct manner adopt a definite routine. Read the following instructions several times and then, with *Guide,* camera and film in front of you, go through the motions until you are thoroughly familiar with them. Then, and not until then, proceed to load with the film itself. Before long the process will become sufficiently automatic so you can do it anywhere and under almost any conditions, remembering always never to load your camera in open bright light.

1. Place the camera before you on a table, so that the back is toward you and the focusing hood on top. Have a carton of film handy.

2. On the extreme left as you look at the camera you will see a slide and button, with an arrow on the slide pointing down. Pressing on the button with a finger, push it down toward the direction of the arrow. When the button has moved down sufficiently, the back of the camera will become loose and you will be able to separate it completely from the camera body. The removable back of the Exa is hinged. The Exakta VX has a new device.

3. Put the camera body and back down. Remove the roll of film from the carton. It is enclosed in a metal cartridge, one end of which is slotted. The end of the film will be protruding from a velvet-lined slit in the side of the cartridge. Pull out some more film until you have a total length of about 4″. This portion of the film, which is necessary to connect the cartridge with the permanent film spool already in the camera, is referred to as the "leader."

4. Now pick up the camera body in your left hand, still with its open back toward you, and hold it so that the closed focusing hood is against the base of your thumb.

5. At each end of the open camera body you will see a cylindrical chamber. In one will be the film take-up spool just mentioned; in the other you insert the film cartridge after first pulling out the rewind knob which is outside the chamber and on the bottom of the camera. Make sure that the slotted end of the film cartridge is on top and directly below the interior portion of the rewind knob. If the re-

wind knob has been properly pulled out, the cartridge will readily enter the chamber. Then pull the leader toward the permanent film spool and be careful to secure the tip of the leader well under the spring tongue of the spool without lifting it. This done, push the rewind knob in so that its lower portion, inside the camera, engages the slot in the end of the cartridge. The take-up spool of the VX is removable. It may be replaced by a standard cartridge, making it possible to wind from cartridge to cartridge and eliminating rewinding. Many careful workers do this to avoid scratches.

6. The cartridge thus inserted and the end of the leader firmly tucked under the tongue of the spool, turn your left hand, still holding the camera body, so that the camera body is parallel to the table and the rewind knob is on top. This is necessary so you may be sure the rewind knob has been pushed all the way back to its original position, firmly against the camera body. If this is not the case, when you replace the back you are very likely to do so without completely enclosing the base of the rewind knob. If this happens, light will leak through the opening and ruin the film.

7. Pick up the camera-back in your right hand in such a manner that the slide and button which you first used to disengage the back are now between your thumb and forefinger and the pressure plate (which is on the center of the inside of the camera-back and serves to hold the film flatly in place behind the lens) faces down. Bring the left edge of the camera-back around the camera body and then slowly move the camera-back down toward the camera body, making certain that the base of the rewind knob is properly surrounded and enclosed. Continue to press the back against the body until the near right side of the back engages the two set pins which you will see inside the camera body; then click it finally into place. To make sure the back is firm and secure see if you can slide or move it; if not, all is in order. It's far easier to do than it sounds. This test applies only to the Exakta I, II and V models.

8a. On top of the Exakta II, V, VX between the combination film advance and counter and the fast speed indicator, you will see a tab which can be lifted up. This controls the gears which wind and rewind the film. It remains down normally in order that the film may be advanced from one frame (each picture on the film is called a "frame") to the next as each exposure is made. When you are ready to rewind the film after having completed a roll, you lift this tab.

Double Exposure. There are times when you intentionally want to make a double exposure (take two pictures, one over the other, on the same frame). To do this, turn your fast speed setting dial arrowwise. It will wind the shutter but will not advance the film and you can proceed to make your second exposure on the same frame. For slow speed, wind the slow speed dial. (Exception: The Exa.)

8*b*. On top of the Exakta I, in the same place but instead of the tab just mentioned, you will see a flat, movable segment which, though it is handled differently, also controls the winding and rewinding gears. When you slide this segment to the right a letter *V* is exposed, indicating that the gears are set to advance the film. When you slide it to the left a letter *R* is exposed, indicating that the gears are disengaged and ready to rewind the film back into the original cartridge.

8*c*. As for the Exa, its winding mechanism is always in the forward position, ready to advance the film. You will find on the Exa, when you hold it in picture-taking position with the lens away from you, a "reversing button" just to the right of the hood. To rewind the film back into the cartridge you must press this button down and hold it down while you turn the rewind knob which is on the other side of the focusing hood. The Exa, you see, was designed to prevent double exposures, which are ordinarily the bane of the beginner and sometimes of the experienced professional. Hence, the Exa winding mechanism is locked until the shutter is released.

8*d*. Inasmuch as you are now getting ready to take your first pictures be sure that the tab we have spoken about is down, if your camera is an Exakta II or V. If you have the Exakta I, be sure the segment is in the position where it exposes the letter *V*. With the Exa you have nothing to remember, because it is always ready to take the next picture.

9. Press the rear round protruding button which controls the focusing hood on top of the camera, so that the hood pops open. As it opens, it simultaneously lifts the shaft of a device which prevents exposing the film when the camera is not in use. Turn your film advance lever to the left as far as it will go. Doing this winds the film to the next frame and, at the same time, cocks (sets) the shutter. The leader you employed to secure the film on the permanent take-up spool has, of course, been exposed to light and is therefore useless, so fresh film must be wound out of the cartridge. To do this, first press the shutter release button (above and to the left of the lens when the camera is in picture-taking position) twice to make sure the shutter is closed, and then rotate the film advance lever all the way to the left a second time. Repeat the shutter release routine.

10. Rotate the film advance lever a third time. Directly under

this lever, on the camera body, you will find a numbered scale and on it two screws or some other type of device enabling you to turn the scale. With your fingernail, turn it in the direction of the arrow stamped on it, until the number 1 is at the apex of the triangular indicator. You now have fresh, unexposed film in place behind the lens, your numbering scale is set for your first exposure, and consequently you are ready for your first picture.

Rewinding. When you have taken as many frames as the film will accommodate (20 or 36 depending on which size cartridge you purchase) it becomes necessary to return the entire strip of film to the original cartridge—a very simple matter. With the Exa, push the reversing button down and hold it down while you turn the rewind knob. With the Exakta I, slide the movable segment to the left until the letter *R* is exposed and turn the rewind knob. With the Exakta II and V, lift the tab and turn the rewind knob. The rewind knob is always turned clockwise, and you continue to turn it until it turns without any tension, when you will know that all the film is back in the cartridge. You may then remove the camera-back and, pulling out the rewind knob, take out the cartridge without damage to the exposed film.

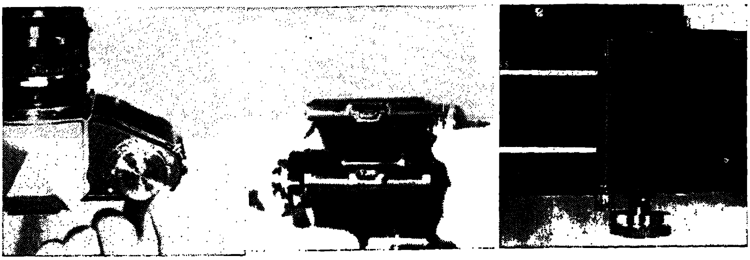
Built-in Knife

An unusual refinement in the Exakta models only, is a built-in knife which permits you to cut your film at any point, so you may develop the exposed portion or merely make a nick in the film at any desired point. The cut indicates where test strips end or where specially exposed and/or unexposed frames join. Unload the exposed film in total darkness and then re-connect the remaining portion of the film strip to the permanent film spool as before by pulling from the cartridge enough unexposed film to provide a new leader. Making a mark in the film serves as a guide or reminder and can be very helpful when you have made certain exposures on a strip of film which you know will require more or less time than normal in the developer or perhaps the use of a special formula, all of which will be explained. The new Exakta VX loads differently.

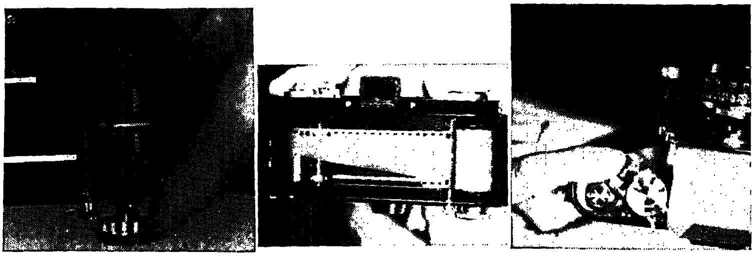
Changing Bag

A changing bag is a handy means, often a life-saver, as a portable darkroom, because it allows removing of cut strips, loading of special emulsions or loading daylight developing tanks wherever you may be.

LOADING THE AUTOMATIC VX



Set the film speed indicator.
Open the camera back.
Pull out this knob all the way.

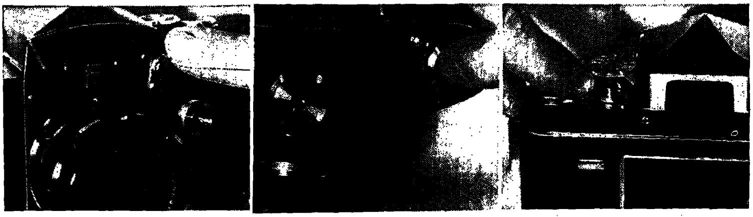


Insert the 35mm cartridge.

The film leader's tongue is inserted under the spring holder of the take-up spool.

The back is closed. The film is wound and released twice, then wound again. The exposure counter is set to 1.

UNLOADING



The safety catch is opened and you can now take pictures.

The inside of the rewind knob is pressed as far as it can go.

The rewind release button is pressed. The film is rewound with the rewind knob until the exposure counter stops turning. Only then, should the back be opened.

CHAPTER 3 / WHAT FILM TO USE

The film which you buy from your dealer for loading into your camera is, as we have stated before, a strip of transparent cellulose acetate, on one side of which has been coated a light-sensitive solution of silver salts in gelatin, called an "emulsion." You can readily recognize the coated side of the film, once it is processed, by its dull appearance. Manufacturers coat films with many different types of emulsions, the constituents of these varying emulsions depending upon the purposes for which the film is eventually to be used. For example, an emulsion (and, consequently, the finished film) may be slow and fine-grained, medium speed and medium-grained, color-sensitive or sensitive to only one color, the reasons for which will be explained later. Consequently it is not enough for you to step up to the dealer's counter and say that you want a roll of film to fit your camera, because the clerk will at once ask you what type of film you want. You must therefore know something about the different films which are made and sold, their qualities, and for what purpose each is best suited. Remember that no one emulsion is completely right for all kinds of pictures and that using the right film for the right purpose is the initial step toward securing the best results.

Two terms with which you will constantly come in contact throughout your photographic career are "negative" and "positive," and we might as well clarify them for you right now, if only because once you have exposed a film it becomes a negative and is constantly referred to as such. For average black-and-white photography the image that you secure on a film after it has been exposed to light and chemically processed, is reversed. The light tones of the original subject become dark and the dark tones light, with the entire image reversed from right to left and top to bottom. The reversal of the image is due to the fact that the rays of light which have entered the camera through the lens, and reached the film, have crossed each other and are reversed in so doing. The exposed film is therefore called a negative.

Now, when we take this negative and use it as a mask over a second emulsion, which may be coated on glass, paper, film, metal, etc., expose that masked emulsion to light and complete a similar chemical processing, we will find that on this new emulsion the tones have been reversed from those of the negative, just as the negative reversed the tones of our original subject. The new emulsion corrects the tones so that they correspond to those of our original subject, an image which faithfully reproduces our original. When an emulsion does provide us with such an image, it is known as a positive.

There are also certain emulsions manufactured which will produce a positive without the necessity of first producing a negative, but while this has certain advantages, it has at the same time a serious disadvantage in that the only way duplicates may be produced is by making successive exposures with the camera, all alike, or by copying the original positive, which is never too satisfactory. We mention this only to indicate that while it is possible to bypass certain steps in the routine of making a finished photograph, we can only do so by yielding other favorable factors of importance. By making a photograph in the customary manner, through first producing a negative, we are enabled to make limitless positives from that negative.

Let us now turn to the accompanying chart on which are listed some of the more common emulsions now offered, both black-and-white and color. The emulsion on color film, by the way—and we are not going to enter into any detailed technical discussion—is one that produces (as a result of quite complicated chemical processing) a positive so far as the color is concerned. In other words, the image, assuming exposure and processing to have been correct, will present the true colors of the original subject. Duplicates, however, are difficult to reproduce with true color fidelity.

There are five columns on the chart. In the first the commonly used emulsions are listed by names, which fortunately are also the terms used to describe the films when asking for them or speaking about them. The second column lists the "speeds" of these different emulsions, by which we mean the degree of rapidity with which they are affected by light. Certain emulsions require a longer exposure to light than others; hence emulsions (and films) are spoken of as being "fast," "medium," and "slow." The "A.S.A." speed numbers that we list are those accepted by the American Standards Association as being correct and calibrated in accordance with their standard methods. In practically all cases these are printed on the carton in which the film is packed or on an instruction sheet inside the carton. Note that in a number of cases two speeds are given, one followed by the letter D and the other by the letter T. D stands for daylight and means that your exposure meter—assuming that you use one, which we heartily advise—should be set for that number when you are shooting outside. T, an abbreviation for Tungsten, indicates the meter speed setting for the same film when you are working indoors under artificial light. As you would expect, because virtually no artificial light can approach the strength and quality of sunlight, an

CHART OF FILM EMULSIONS WITH RECOMMENDATIONS

Type of Emulsion and Film Name to Ask For	*A S A. Speed*	*Purposes for Which This Emulsion is Best Suited*	*Sensitivity*	*Suggested Developing Time a 68° F*
Plus-X; Supreme; Superior 2· Etc.	50 D. 40 T.	General all-around film, with medium grain	Panchromatic	D-76—11 min. DK-20—12 min.
Ultra Speed; Superior 3; Panchromosa; Etc.	100 D 80 T.	Indoor portraits with normal room lights. sports; wherever speed is "must"; film of moderate grain	Panchromatic	D-76—13 min. DK-20—15 min.
Panatomic-X; Finopan; Superior 1; Panchromosa Micrograin; Etc.	25 D. 16 T.	For fine detail, photomurals; projection; photomicography; fine grain	Panchromatic	D-76— 9 min. DK-20—10 min.
Positive and high contrast positive	3 T.	Black-and-white copying; printed matter, etc For slides and diapositives	Blue only	D-11— 7 min. D-11— 4 min.
Micro-File; Minipan; Microcopy, Etc.	3 T.	Copying multi-colored subjects such as paintings, prints, etc.	Panchromatic	D-11— 5 min.
Tri-X	200 D. 160 T	Highest speed for existing light photos	Panchromatic	D-76—12 min.
Direct Positive	64 D. 50 T	For immediate black-and-white positive without intermediary negative	Panchromatic	Home kit or special formulae.
Infra-Red (with filter) #87-B—Red #25-A—Red	4 T. 8 T.	For night effects in daylight; dramatic skies; medical and dermatological uses	Infra-Red	D-76— 9 min. DK-20—10 min.

COLOR FILM

Kodachrome, Daylight Type	10 D.	Full real color rendition of outdoor subjects	All colors at 6,500°K	Kodak Laboratory processing only
Kodachrome, Type F #82-A	10 D.	Full real color rendition of subjects indoors with artificial light	All colors at 3,400°K	Kodak Laboratory processing only
Anscocolor, Daylight	12 D.	Full real color rendition of outdoor subjects	All colors at 6,500°K	Ansco Laboratory or with home kit.
Anscocolor, Indoors Conversion #11	12 T. 12 D.	Full real color rendition of subjects indoors with artificial light	All colors at 3,200°K (Not photofloods)	Ansco Laboratory or with home kit.
Ektachrome E 2	10 D.	Full color	All colors	Kodak or Local Color Lab.
Ektachrome F		Indoor balanced to flashlamps #5, #25, and similar	All colors	Kodak or Local Color Lab.

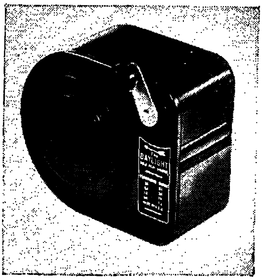
Advances in film emulsion manufacture often produce a change in speed ratings, which require revisions in new printings of this book. If we recommend a shutter speed or iris opening for an A.S.A. 50 film and when you buy it and find that the rating has been changed to A.S.A. 80, then either stop down the iris one-half stop or use a 50% faster shutter speed.

identical emulsion is slower under artificial light than daylight. Most films are very sensitive to blue light and the tungsten filament in an incandescent lamp does not emit the same proportion of blue light that there is in sunlight. The difference, as the chart indicates, is even greater with color film, so much so that the manufacturers make entirely different types of color emulsions for the two types of work, outdoors and indoors. While we are on the matter of color film, note also that in the fourth column we speak of colors "at so many degrees K." The strength of a color varies with the strength (or heat) of the light and K is an abbrevation for "Kelvin," the name of the heat temperature scale. More about this later.

Column three lists the chief uses of the respective emulsions. The next column, headed "Sensitivity," indicates the colors of light to which the particular emulsion is most sensitive. All the colors that the human eye recognizes are contained in the ordinary white light that is all around us. This can be understood when a ray of light is passed through a prism, or three-faced piece of glass, whereupon the ray of light broadens and breaks up into a band of colors known as the "spectrum." No photographic emulsion can be—or at least has yet been—made that will render all colors accurately in their respective shades of gray on a black-and-white film or paper. The emulsion which approximates this most closely is that known as "panchromatic, type B," and because that is the emulsion, obviously, which is most suitable for most purposes, we list chiefly such emulsions on our chart. Actually there are three types of panchromatic emulsions but in the 35mm film size which our camera takes, only the type B is made. In the last column of our chart the most suitable type of developer is listed for each emulsion, as well as the recommended time of development in minutes; as indicated, certain color films can only be processed at the manufacturers' laboratories.

The user of 35mm film, the size required for our camera, is fortunate in that he may be able to buy film in bulk, to wind on his own cartridges. This can reduce the film cost per picture to as little as ¾¢ contrasted with a cost of 3¢ when film is bought in the original cartridges. But, if you buy bulk film, make certain that your source of supply is trustworthy and that you are getting fresh film. It is foolish to try to save a few pennies at the risk of not securing good negatives. A saving of a couple of cents per picture may mean a later loss of dollars in time and money. A satisfactory type of bulk film winder is illustrated here, but again we want to caution the beginner to buy standard cartridges of film until he is sure of what he is doing.

Many of us have no time to experiment with different emulsions and want only to be sure of getting the best possible pictures with the least amount of complication. If that is your situation, we recommend for all-purpose use one of the films with a speed of A.S.A. 50, such as the first classification shown on the chart, as being the closest approach yet made to a multi-purpose film. Finally, while we advise that you thoroughly accustom yourself to the use of one emulsion, it must be remembered that for the finest results specific emulsions are manufactured and recommended for specialized purposes.



TYPICAL BULK FILM WINDER

CHAPTER 4 / HOLDING AND FOCUSING THE CAMERA

There are two methods of holding the Exakta, depending on whether you are going to use the ground-glass focusing hood to look down at the ground-glass with the camera approximately at chest-level, ideal for low shots, as in the garden where bending would be troublesome, or are using the penta prism and the camera at eye-level. We'll discuss the chest-level method first because it is the oldest method.

With the Standard Lens. Pick up the camera with your left hand, the back of the camera towards you. Position the fingers so that the little finger fits under the camera body and acts as a support. With the remaining fingers grasp the camera so the forefinger rests on the shutter release and the third or middle finger touches the knurled focusing knob which is attached by a lever to the base of the lens barrel, below the shutter release. With the left thumb placed at about the center of the camera-back you will have a sufficiently firm grip of the camera to permit fine focusing and even to permit releasing the shutter all with the one hand, which will be necessary if, at any time, you are holding an extension flash reflector in your right hand.

For normal shooting it will be better to grasp the camera similarly with the right hand as well, in which case both middle fingers can grip and rotate the focusing knob or, when desired, the right thumb and forefinger can grasp the lens barrel and rotate that instead of the focusing knob. So, held with one or both hands, the best position for the camera will be about 10″ below the eyes.

With a Telephoto. If you are working with a telephoto lens instead of your standard camera lens, the manner of holding the camera will have to be slightly altered because such lenses, longer and heavier than the standard lens, change the balance of the camera by adding all this weight at the front. So, to take care of this hold the Exakta as before with your left hand, but turn your right hand so that lens and camera rest in the hollow of the right palm. This assures the needed added support and leaves the thumb and forefinger of that hand free to rotate the lens barrel for focusing.

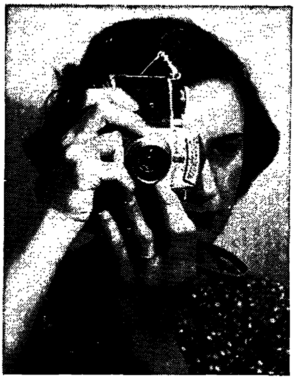
Focusing

To "focus" the lens, which means adjusting it so that the image on your film will be sharp, first set the lens at widest opening. This will be the lowest number of a series on the outer ring of the lens and may be—depending on which model of the Exakta you have and what type of lens is fitted to it—3.5, 1.9, 2.8, etc. (In this chapter we are explaining only the mechanics of focusing; we shall tell you about the meaning and purpose of these numbers in detail later.) Having turned the ring until the lowest number reaches the point at which the ring stops moving, having moved your film advance lever as explained in Chapter 2, and with your focusing hood open, you will see the image of what you propose to photograph on the ground-glass. The subject will be right side up and the full size of your image, but will be reversed from right to left unless you are using the penta prism, in which case the image will be just as your subject appears before you.

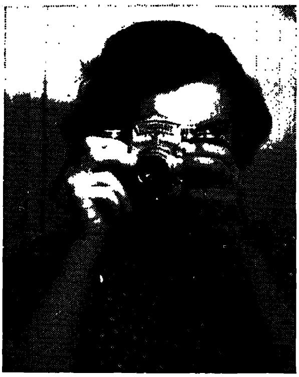
The image will probably still be blurred or fuzzy, so rotate the knurled focusing knob with your middle finger or fingers until the image becomes perfectly sharp. A good way to practice this is to fasten a page from a newspaper to a wall and aim the camera at it and rotate the focusing knob until the type all over the page is perfectly clear and legible. Then your lens will be "in focus." This will also give you a chance to see what happens when you do not hold your camera straight. If your vertical columns are all parallel, you are holding the camera correctly. If they are narrower at the top than at the bottom, you are tilting the camera backward; if vice versa, you are tilting it forward. You have often seen pictures in which the lines of buildings were not vertical, and tilting the camera is the cause. While performing this experiment in securing sharp focus, you will also learn to hold the camera correctly.

Bracket Ground-Glass Focus: You will find that you will often have to "bracket" your focus. In other words, there will be a zone in which the image is not sharp, and you will find as you rotate the focusing knob (or the lens) the image will become sharp and as you continue the rotation it will again become unsharp. After some practice you will have no trouble in focusing accurately and rapidly by hitting the point of sharpest focus.

Rangefinder Prism: There will be times when "wire-sharp" focus is needed; in a shallow plane like a curtain, perhaps on some detail of a subject or perhaps when you are photographing a very small object. By wire-sharp we mean focusing of extreme position. For this purpose the Exaktas have two magnifiers. The first (1½X) is fixed over the ground glass. The second, built into the hood, can be pulled up into position so that you can focus with great accuracy. While it magnifies only a portion of the image, of course if you get that portion



HOLDING THE EXAKTA V FOR VERTICAL COMPOSITION



HOLDING THE EXAKTA V ORTHO PRISM FOR HORIZONTAL COMPOSITION

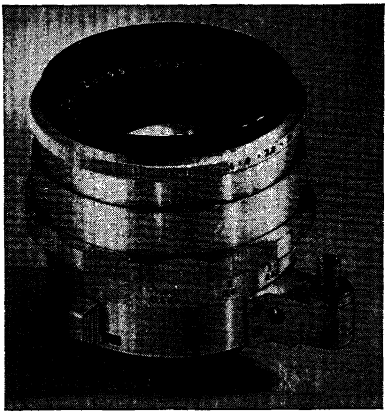
into perfect focus it follows that the remainder will also be accurately focused. When you use this magnifier, you must remember to swing it out of the way when you are ready to take the picture, because it shows too small a portion of the entire image to permit you to check on your complete composition.

Rangefinder Prism Focusing: The revolutionary Rangefinder prism focusing for the Exakta makes it possible to assure every picture is a sharp picture. The lines or contour of an image is straight when in sharp focus or it appears split or toothed when out-of-focus. The rangefinder has some limitations in that focusing with it is difficult if the iris is at f/8. However, as the one-stage automatic pre-set or two-stage pre-set diaphragms are wide open at f/2 or f/1.5 for focusing, this limitation exists only with non-pre-set diaphragms.

When the image is sharp, the iris must be narrowed from the wide-open focusing position. You have been told that either the pre-set, which does so in two stages of selection and narrowing, or the automatic pre-set diaphragm, which does it in one stage, are preferred.

The Automatic Diaphragm

A revolutionary boon to Exakta photography occurred with the development of the automatic diaphragm because it reduced the number of steps needed to take a picture. Each manufacturer, Scneider of the Xenon and Nestagon, Zeiss with the Biotar, and Steinheil with their Auto-Quinor, make a different type because of patent regulations.



ZEISS BIOTAR WITH AUTOMATIC DIAPHRAGM

In Chapter 1 we spoke of the most modern focusing development for cameras of the reflex type, the penta prism, which may be placed permanently on the Exakta V, VX, and the Exa, and may easily be attached non-permanently to the two other models. As we said, this prism throws the image on an upright appearing rather than a horizontal viewing screen and, at the same time, corrects the reversal of the image from left to right so that you see it exactly as the subject is before you.

The difference in using the Exakta with this prism is that now you hold the camera up to your eye instead of looking down at the image. For a horizontal picture, the camera is grasped just as we explained in the second paragraph of this chapter; but the camera is held up to the face so that the eye, the subject, and the image are all on the same plane. To steady the camera, hold your elbows to your sides. You will have no difficulty in following a moving object, because now the image you see will be almost life-size and unreversed as compared to the image you saw before under the hood, where it was smaller and reversed. In using any reflex camera with a regular hood, looking down at the image and focusing on a moving object, will cause you to move the camera in a manner which appears to be opposite to the direction taken by the object. This can be rather confusing until one becomes accustomed to it. No such problem exists when you are using the pentaprism.

If the subject requires a vertical composition, our recommendation is that the camera be held in the left hand with the hollow of the palm cradling the chin. The right hand focuses the lens. The camera will rest against the nose. This provides a rock-steady grip and easily permits one-hand shutter release operation after preliminary focusing.

You will often read or hear that the viewfinder on this or that camera is or is not "corrected for parallax," so we might as well explain to you now that parallax, as defined by Webster, is "the apparent displacement of an object as seen from two different points." While parallax is not a serious matter to the average camera user, it can be very important to the precision worker, and various steps have to be taken to correct for it whenever viewing and focusing are accomplished by means of a separate viewfinder and/or rangefinder, as is the case with so many cameras.

Having told you what parallax is as part of your photographic education, we can now also tell you that, as the owner of an Exakta, you may proceed to forget about it, except with the open sports finder of the waist level hood at close distances. With the Exakta, you focus and view through the same lens (and this applies also when you are using supplementary lenses or tubes, or have substituted a telephoto or wide-angle lens for your standard lens) with which you make the exposure and take the picture. Thus, there is no parallax problem and you may use your Exakta without change or compensation for even such precision types of work as photomicrography, telephotography and the like, all of which we shall discuss in Chapter 23.

Sports Finder. Under normal conditions, by turning the focusing ring on the lens, you will have no difficulty in focusing subjects as sharply as you may desire; but there will always be occasions (for example, when you are taking pictures of fast action during some sports event) when you have all you can do to follow your subject or subjects in the open sports finder. The open sports finder, by the way, is part of the hood assembly used as the focusing magnifier. For use as a sports finder, it is formed by lifting in and up on the magnifier and out and up on the Exa. Exakta II and the Exakta V's metal magnifier protector flap (when using the latter without the pentaprism), or simply by folding down the magnifier on the Exakta I, and is resorted to when there is simply no time tc focus in the ordinary manner.

Altering Sports Finder for Telephoto Lenses. The only time the field of view shown by your ground-glass will be altered with respect to the open sports finder will be when you are using a telephoto lens which, while the lens provides a larger image from the same camera position, necessarily covers a smaller amount of the image. It will then be necessary to cut a cardboard mask to fit into the front of the opening of the sports finder, with an opening cut in the center of the mask showing the smaller field of view of the longer focal length telephoto lens. A 100mm lens will have ½ the regular opening in all directions, a 135mm lens will only show about 40% of the field.

CHAPTER 5 / TAKING THE PICTURE

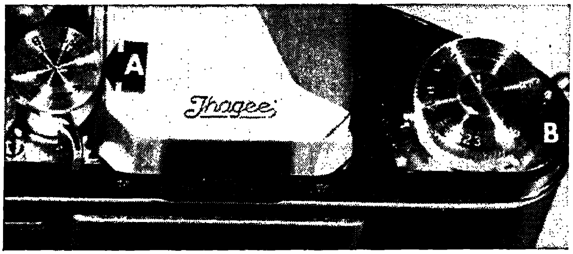
As more refinements are added to a camera by its designer to increase its versatility, the more it departs from extreme simplicity in operation and the more it becomes necessary for the user to accustom himself thoroughly to the correct and efficient handling of its various parts. Assuming that you have learned to focus your Exakta correctly and have it properly loaded, there still remains a need for further study of the purpose of the shutter-setting knobs and the light-admitting iris in the lens. Unless a precision built camera like the Exakta is manipulated with understanding, its mechanism may easily be injured.

As we remarked earlier, the Exaktas (with the exception of the basic Exa model) are unusual in having a shutter speed range from 1/1000 second to 12 seconds. In addition all models, except the Exa, are equipped with a focal-plane shutter, a self-capping, rubberized cloth curtain which travels across the film in a manner similar to that of a window shade being pulled over a window, except that the window shade travels vertically and the shutter horizontally. This type of shutter assures a negative uniformly exposed from edge to edge.

The Self-Timer

An additional refinement on the Exaktas is the ability to delay the action of the shutter release when desired. When this is done, the shutter does not operate for a period of approximately 13 seconds (fast or slow-speed setting). This allows ample time for you to get into the picture yourself. It is valuable for taking pictures on tripods or in copying where vibration may exist. The self-timer dampens vibration so that none exists by the time the exposure is made.

Fast-Speed Setting. To the left of the focusing hood, when you are holding the camera in position ready to take a picture, you will find a knob on which are stamped the markings: *B, Z,* 25, 50, 100, 150, 250, 500 and 1,000, plus a red dot imprinted on the edge of an inner circular portion of the knob. This is the fast-speed shutter-setting knob. The letter *B* stands for "bulb," a throw-back to the days when shutters were operated with a bulb and tube, the idea being that the shutter would remain open so long as pressure was maintained on the bulb. Today the same result is obtained with what is known as a "cable release," a wire plunger of lengths varying from only a few



A. FAST SPEED DIAL
B. SLOW SPEED DIAL

inches to as much as 60 inches, enclosed in a protective flexible cable. This has a threaded screw tip at one end which usually fits into the center of the shutter release (though sometimes into another location on or near the lens), and a pressure device at the other by means of which the plunger may be pushed through the cable until it actuates the shutter. At this *B* setting, remember that the shutter remains open so long as pressure is maintained on the shutter release knob or cable release. The next letter, *Z*, stands for "time" and is used for any exposure of a definite length of time which the user has determined in advance. Your Exakta, for example, can be set to take care of speeds up to 12 seconds' duration through the use of the slow-speed knob; for longer exposures you must use the *Z* setting ($Z = T =$time).

The difference between the *B* and *Z* settings is that at the *Z* setting your first pressure on the release opens the shutter, and it remains open until the release is pressed a second time. With the *B* setting, you must stay at the camera with your finger on the shutter or cable release until you finish the exposure by relieving the pressure. With the *Z* setting, having pressed the release, the shutter will remain open until you press the release again, enabling you to leave the camera and do something else if the exposure is a lengthy one.

The various figures from 25 to 1,000 on the fast-speed knob indicate exposures of fractions of a second and when the shutter is set for any of these, an exposure of that desired duration results automatically when the release is pressed, or "tripped" as this action is frequently termed. To adjust this fast-speed knob for the desired exposure, lift it between the thumb and forefinger of your left hand, gently, as high as it will go. Turn it until the desired letter or number is beside the red dot. When you release the knob, it will drop back into place with the letter or number beside the dot and your shutter is set. So far as the Exa model is concerned, you are always ready to make your exposure because that camera has only one lever and on it is only the one letter *B* and speeds from 1/25 to 1/150 second. Moving the lever opposite any setting readies the camera for the exposure.

Slow Speeds. On the Exakta I, Exakta II, Exakta V and Exakta VX you will find a second knob, the slow-speed knob, to the right of the focusing hood. This knob not only controls the slower speeds of the shutter, but it is also used to control the delayed action mechanism for *all* speeds. Whichever knob you use, or whether you are using both as will be explained, you must *always* advance your film before setting the shutter.

On this slow-speed knob you will see two sets of markings, one in black and one in red. Concerning ourselves now solely with the black markings which read: 1/5, 1/2, 1, 2, 3, 4, 5, 6, 7, 8, 9, 11 and 12, the first two represent shutter speeds of a fifth and half second respectively, and the others indicate intervals of one or more full seconds. To use the slow speeds, first cock the shutter. Then set the fast-speed (left) knob at either *B* or *T;* then gently wind the slow-speed (right) knob clockwise (to right) as far as it will go. It must be fully wound. Otherwise, incorrect shutter speeds will result. This is to set the mechanism. That done, lift the slow-speed knob gently between the thumb and forefinger as high as it will go and turn it (either to the right or left because the direction does not matter) until the desired speed is opposite the red dot which you will see on the inner circle of the knob, placed similarly to the red dot on the inner circle of the other knob. Now, when you trip the shutter, whether with your finger on the shutter release or with a cable release, the shutter will remain open for the desired time.

If you would like to see just how this ingenious mechanism operates, you can do so by removing the lens. Press the bayonet release lever of the lens and rotate the lens with a slight upward and outward tension until it pops out of the mount. With the lens out, try various shutter combinations. To replace the lens, align the red dots on the camera body and the lens, put the lens in place, press it down slightly and then rotate it until the bayonet lever clicks into place in the side of the lens.

To repeat in brief:

Regular Speed Settings

For high speeds or for bulb or time exposures:

1. Advance the film.
2. Lift the left (fast-speed) knob and turn until desired is beside the red dot.
3. Release knob.

For slow speeds:

1. Cock shutter.
2. Advance the film.
3. Lift the left (fast-speed) knob and turn until the letter *B* is beside the red dot. Release knob.
4. Wind the right (slow-speed) knob to the right as far as it will go.
5. Lift this knob and turn until the desired speed is beside the red dot.
6. Release knob.

In taking the picture, gently squeeze the shutter release to minimize vibration.

Now for the red numbers on the right (slow-speed) knob. These are to be used when you want to delay the action of the shutter. Of course, this delayed action is not used in the case of bulb (*B*) or time (*Z*) exposures. The procedure is as follows:

Delayed Action Settings

For high speeds with delayed action:

1. Advance the film.
2. Place left (fast-speed) knob at desired speed as already explained.
3. Wind right (slow-speed) knob to the right as far as it will go.
4. Lift right (slow-speed) knob and turn to any red mark.
5. Press shutter release and approximately 13 seconds will elapse before the shutter operates.

For slow speeds with delayed action:

1. Advance the film.
2. Place left (fast-speed) knob at *B* as already explained.
3. Wind right (slow-speed) knob to the right as far as it will go.
4. Lift right (slow-speed) knob and turn to the desired speed.
5. Press shutter release and approximately 13 seconds will elapse before the shutter operates.

With the Exa:

1. Advance film by winding the right-hand knob.
2. Set speed lever opposite desired speed.
3. Gently press the shutter release.

Finally, the Iris Setting

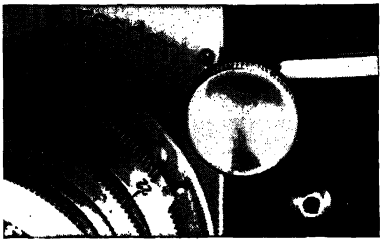
Only one picture-taking element remains—the adjustment of the iris opening of the lens. While the shutter setting determines the length of time during which the film will be exposed to the light, you must in addition control the amount of light which will enter the camera and the adjustment (we might almost consider it as a valve) which does this is known as the "iris." This, which provides a circular opening at all times, widens or narrows in order to produce a larger or smaller space through which the light may pass, and thus controls the amount of light. On the outer ring of the lens engraved numerals are found which indicate, successively, the largest opening, and then a series of other openings each of which will, progressively, admit half as much light as the previous opening. This we shall explain in more detail in Chapter 6. An automatic pre-set diaphragm so simplifies the narrowing problem that one should be on every camera.

So much for the fundamentals. Now, with the Exakta loaded and properly set, and a complete understanding of its operation, you are ready to take a picture. When you use shutter speeds of 1/25 second or slower, a tripod or other firm rest for the camera is a "must." At such speeds, the camera cannot be held sufficiently steady in the hands to avoid blurred results. When using a tripod, a cable release is an almost equally essential accessory, especially because the shutter release on the Exakta moves in a horizontal plane rather than in a down thrust. When held in the hand or against the face or body, the release is smoothly squeezed, and there is counter-pressure to steady the camera which does not exist when the camera is on a tripod; hence, the need for the cable release. Should such a release not be available, it is best, when using the Exakta on a tripod, to employ the delayed action method as the 13 seconds which elapse before the exposure takes place will allow time for the camera and tripod to re-steady themselves.

Camera Stance. Even at fast speeds, to minimize any motion or vibration it is well to hold your breath while making an exposure. Stand rigidly with toes pointed in, feet about 8 inches apart. Breath in. exhale, and then hold your breath. Smoothly, release your shutter.

Remember that you are making very small negatives—only 35mm—and that almost certainly the resulting prints will be made by enlargement. The slightest degree of motion will show up as a serious overall blur of the objects in the enlarged, finished photograph.

Closing Iris after Focusing. Finally, if your iris is NOT an automatic pre-set, always remember to close the iris to the proper opening when you focus with your lens wide open (at its widest opening) before you trip the shutter to take the picture. Failure to do this will result in ruined, wasted films. You can always assure yourself of good results by focusing, a) at the stop you are going to use, b) by using a pre-set automatic diaphragm, or c)—if you must focus with the lens wide open—by having a sure-fire memory. In short: *remember to stop down,* "stopping down" being photographers' jargon for closing the iris to a narrower opening.



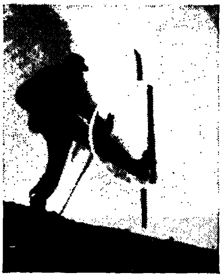
GIANT RELEASE KNOB. EXCELLENT FOR NEVER-MISS CONTACT WITH FINGERS; IDEAL FOR USE WITH GLOVED FINGERS.

CHAPTER 6 / SHARPNESS BY HYPERFOCAL DISTANCE, DEPTH OF FIELD AND PIN-POINT FOCUS

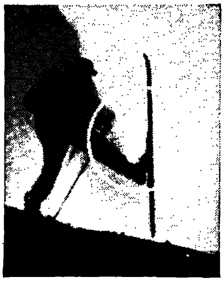
"Sharpness" in photography is a relative term. A picture that is sharp when viewed as a contact print may be unsharp when it has been enlarged only two or three diameters. The photographic image is made up of innumerable small particles (let's call them "dots" for convenience) of deposited silver in the gelatin emulsion on the sensitized film. Due to an optical property of the human eye known as the "circle of confusion," the eye cannot distinguish between dots which are 1/100″ or less apart, at the normal 10″ viewing distance. A group of such dots, as seen by the eye, appear to constitute a solid tone. But if the dots are enlarged only two diameters, the separation between the dots will have been increased so that they are only 1/50″ apart. They then become visible to the eye at the normal 10″ viewing distance and our picture has what is called "grain," which is a very disturbing effect. You'll learn more about grain and fine-grain in Chapter 12. By narrowing the opening of your lens (the iris) you reduce the separation between these dots of silver which form the image on the film, and later on the print. The dots being closer together, you can later enlarge to many more diameters before the dot separation will be such as to be noticeable, i.e., before you will have a "grainy" enlargement. Accuracy and care in focusing is still the best recipe for sharp pictures.

The ground-glass viewing screen on all the Exaktas (or the penta prism on the Exakta V) is an extremely precise means of accurately adjusting the lens for the distance between the lens and the subject, and thus assuring yourself of correct "focus." Broadly speaking—and mind you, this is no scientific definition—a picture is "in focus" when there is a general all-over sharpness of the image.

This is known as the "hyperfocal distance." Here again, for lack of space and because this is no formal treatise, let us briefly explain this term by saying that it represents the distance in feet (or meters, depending on how your lens is calibrated) at which, when the lens is set for a certain distance on the distance scale imprinted on the barrel and at a corresponding f/opening, all portions of the subject will be in focus (sharp) from a point approximately half the distance marked on the distance scale to infinity.



THE BROKEN SKI IN THE PICTURE ON THE LEFT SHOWS THE SUBJECT IS OUT-OF-FOCUS IN THE SPLIT IMAGE RANGE-FINDER. BRINGING THE SUBJECT IN LINE PRODUCES A SHARP FOCUS.



The Hyperfocal Distance for Over-all Sharpness

The actual degree of all-over sharpness which is possible with any camera and lens depends on three factors: the degree of accuracy with which the lens-to-subject distance can be measured, the shortness of the "focal length" of the lens itself and the f/opening used. The focal length of a lens is, briefly, the distance (when the lens is set at infinity) from its optical center to the plane of the film on which the exposure is to be made.

Over-all sharpness is easily assured because the lens distance scale gives you the scale point at which over-all sharpness can be secured. The short focal length of the standard 50mm lens has an inherently large area of front-to-back sharpness and even relatively wide openings produce an adequate span of sharpness. Merely focus at the critical point, called the hyperfocal distance, and at a given opening everything from half this distance to infinity, written as ∞, will be in focus.

This may sound rather complicated, but you will understand it readily enough upon consulting the simple table below. In the first column of that table are listed five basic openings or F/ stops of the lens on your Exakta. In the next column are the numbers (indicating distances in feet or their equivalent in meters) to which you should move the focusing scale (or ring) of your lens when using the indicated openings. In the third column appear the distances in feet between which everything in your picture will be in focus.

HYPERFOCAL DISTANCE TABLE (for lenses of 5cm focal length)

Lens Opening	*Distance Setting in Feet or Equivalent in Meters*	*Everything Will Be in Focus (Feet or Equiv. in Meters)*
F/3.5	50	from 25 to infinity
F/4	42	from 21 to infinity
F/8	21	from 10½ to infinity
F/16	11	from 5½ to infinity
F/22	9	from 4½ to infinity

If you know that you will need great enlargements from the resulting negative, set your lens one or two openings narrower than indicated in the table (increase the exposure, of course). You will find a table of meter equivalents at the back of this *Guide.* It is easier to remember the hyperfocal distances above, if you keep in mind a 2″ lens set at F/4 at 42′ as the key figure. Remember the number 2/4/42.

Now put this table to practical use. Let's suppose you want to take some shots at a football game where the action is all over the place, fast and furious. As a spectator you cannot get on the field, and you know that nothing is likely to take place closer to you than 10½′. Very well, you set your opening for f/8, the light being good, and turn the focusing ring on the lens to 21′. So long as you do not change the lens opening or move the focusing ring, you can make all the shots you wish and be assured that everything will be in sharp focus from a point 10½′ away from you to the full length of the field and back.

Hyperfocal distance for lenses of different focal length. Mention was made that the key figure for the hyperfocal distance chart was f/4, 42, 2. This means that at f/4 with a setting of 42 feet, and a 2″ lens, everything from half the distance given or 21 feet to infinity will be in sharp focus. At f/8, the figure now becomes 21 feet, and at f/16, 10½ feet, with everything from half the given figures to infinity being sharp.

For different focal lengths, this still is the key figure in that if you have a 4″ lens, with the *same* opening f/4, everything is doubled so that at a distance scale setting of 84 feet, everything from half that distance to infinity will be in sharp focus. As you stop down double the number, e.g., to f/8; your new figure is 42.

For an 8″ lens, at f/4, the distance scale figure would be 168 feet.

For a 3″ lens, at f/4, since three inches is 1½ times two, the distance setting would be 63.

Another way for finding the hyperfocal distance is to bring the ∞ mark to the f/opening that you intend to use.

Depth of Field—Limited Areas of Sharpness

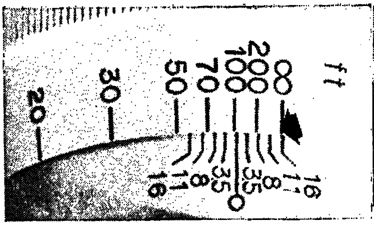
Using Depth-of-Field Scale. On the lowest ring of the lens, the one closest to the camera body, you will see a triangular mark (usually in red) and on either side of it a series of numerals which are identical with the f/ stops of the lens, each pair of similar numerals being equidistant from the triangular mark. On the focusing ring of the lens, directly above or in front of the ring just mentioned, you will see another series of numbers, these indicating distances in feet or meters. Having selected the opening you are going to use and having focused your lens on the chief portion of your subject by means of the ground-glass or ortho prism, look at the lens barrel. Let's assume you are using an f/8 opening, as shown in the illustration. Where the numeral 8 appears on one side of the mark on the lowest ring, the number just above it on the focusing ring will indicate a distance of 1.5 meters (or 5 feet); where the numeral 8 appears on the other side of the mark on the lowest ring, the number just above it on the focusing ring will indicate a distance of 2.5 meters (or 8 feet). This means that everything in your picture between those two distances will be in correct focus. So, without calculations or tables and solely by looking at the lens barrel, once you know the opening you are going to use, you can select any distance sharpness required, or vice versa. In other words, the narrower the opening you use, the greater your depth of field, or the greater the distance over which everything in your picture will be in sharp focus.

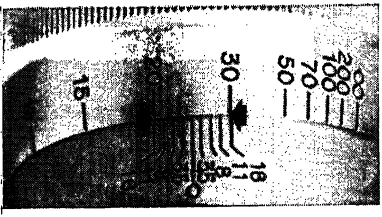
If a room requires sharpness from 8 to 15 feet then a f/00 stop must be used. More light must be "poured" into the room until this light value has been built-up.

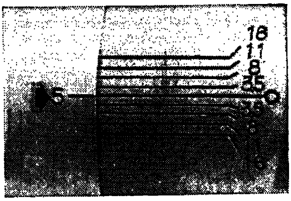
Pin-Point Sharpness

There will be many occasions when you will want sharp focus over a limited range of distance, as in portraiture, but are not interested in getting other or far-away objects into complete focus. Then your depth-of-field scale really comes into play. Because modern Exakta lenses have this information calibrated directly on the lens barrel, you do not have to engage in lengthy calculations nor do we need to add to your problems with depth-of-field charts and tables, which are therefore omitted. Use an opening that is wide enough for only a thin curtain of sharpness.

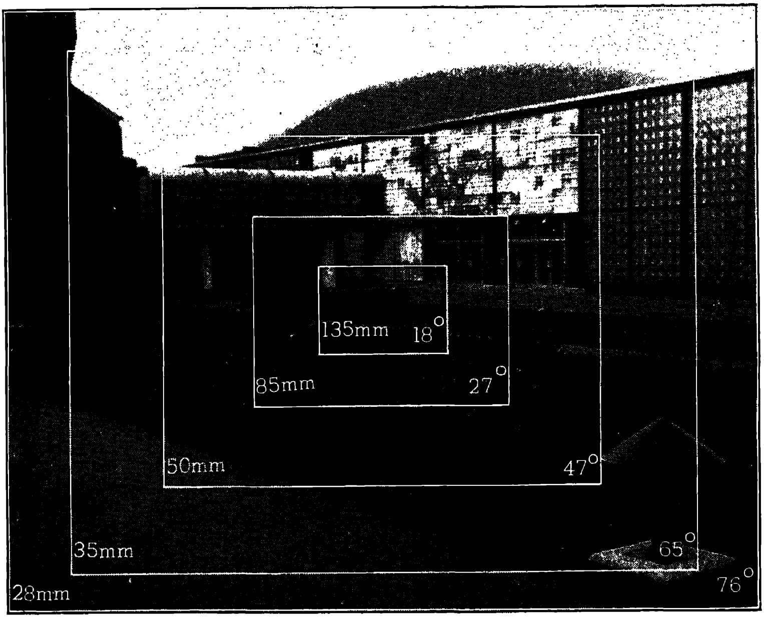
Thus you have, with the Exakta and its short focus lens, three methods of assuring yourself of correct focus under virtually any conditions: (a) normal pin-point focusing with the reflex ground-glass or the penta prism; (b) the depth-of-field scale on your lens, and (c) use of the hyperfocal distance. Using the hyperfocal distance you can work entirely without the ground-glass by taking advantage of the open sports finder on the Exa, Exakta I and Exakta II, or the Exakta V when used without the penta prism. You can, for example, set your distance for 9′ and your lens at f/22 and, for all practical requirements, everything in your picture will be sharp from 4½′ to infinity. At times you may want to be certain of the sharpness of some







Hyperfocal distance settings can be made by bringing the infinity mark opposite the f/ number being used (upper left). The depth of field effect can be estimated by placing the desired depth between the two same f/ openings on opposite sides of the focusing index (upper right). Critical focusing depth is very shallow at ultra-near distances (left).



The subject area covered by lenses of various focal lengths as seen from the same point of view.

object in the extreme distance; in that case, even better results can be secured by setting the lens at the infinity mark on the depth of field scale—a mark which looks like the numeral 8 on its side (∞).

Before closing this chapter, let us remind you again that when you know a picture you are taking is to be enlarged very materially, you must always narrow your lens opening one or two stops. Returning to our example above where you want everything sharp between 1.5 and 2.5 meters from the camera, and the scale indicates f/8, narrow your stop to f/11, or even f/16, depending on the degree of enlargement which will be required.

CHAPTER 7 / SETTING UP AN OUTDOOR EXPOSURE

Earlier in this book you learned how to operate your camera and how to load it with film. Let us assume now that you have a roll of film in the camera and are ready to start making some pictures. We have advised that for the present you select the first emulsion listed on the emulsion chart: a medium-speed, medium-grained film such as Plus-X, Supreme, Superior 2, Panchromosa, or the like, all of which have an A.S.A. speed of 80. Before you can take a picture on your film there are two controls on the camera which you must learn to manipulate.

When you look into the lens, which is set in its mount, you will see in its center a circular opening through which the light is admitted to the camera and on through to the film. This opening, always circular in shape, becomes wider or narrower as you adjust its controlling ring. The device which opens and closes is known as the "iris" and is composed of very thin, flat, small sheets of metal which slide over each other to expand or contract the opening. This variable opening, controlled by the iris, enables you to govern the amount of light you admit to the camera. This is very important because the brighter (stronger) the light, the more it affects the emulsion on the film. You will notice a scale on the side of the shutter over which a small lever passes as you widen or narrow the iris opening, and on that scale you will see various numbers. Some will be whole numbers and some will have decimals and they will read in rotation, starting with 3.2, 3.5, 4, 5.6, 8, 11, 16, or the like. The numbers may differ depending upon the particular camera and lens you are using, but the principle is always the same.

These are called the "f" numbers, which means that each of these various-sized openings bears a definite light-admitting relation to the focal length of the lens. The "focal length" of any lens means the distance measured in inches from the optical center of the lens itself to the focal plane (the flat surface) of the sensitized film on which the photographic image is produced. Thus an opening of f/2 means that you are working with an opening having a width equal to half the focal length of the lens, while an opening of f/32 means that the opening is only equivalent to $\frac{1}{32}$ of the focal length. In other words, the lower the f/ number, the wider the opening you are using and, consequently, the more light you are admitting to the film. Thus it follows that when you are working with very strong or brilliant light, which of course will affect the film more powerfully and more quickly, you narrow the size of the opening, and vice versa. In common photographic usage these various f/ numbers are called "stops," thus making it possible to describe and refer to them regardless of their actual numbers. You might, for example, be using a lens with stops of f/3.5, f/4.5, f/6.3, f/9, etc., but in giving general instructions it becomes more simple to tell you to use an opening several stops wider or narrower than the one you have first selected, without confusing you with numbers. Your first stop, the one with the lowest number, is always the widest opening. The capable speed of a lens, by the way, is always referred to by its widest opening: you would speak of your lens as being, perhaps, an f/2, while another photographer might have an f/6.8 or an f/1.9.

Just as important as the amount of light admitted to the film by controlling the size of the stops, is the length of time during which the light is admitted. So, your second control is governed by what is known as the "shutter." The shutter enables you to keep the iris opening (from now on let's call that opening the "aperture" to avoid confusion) open for light to reach the film for any definite length of time you may select. The length of time you want the aperture to remain open is controlled by setting the shutter, which is operated by speed setting dials. On the dials you will find engraved figures and letters indicating the various speeds at which the shutter works, such as 1/5 of a second, 1/25, 1/50, and so on, in addition to "T" (which stands for "time exposure") and "B" (standing for "bulb exposure"). With the lever set at T, when the shutter release is tripped the shutter will remain open indefinitely, hours if desired, and will only close when the release is tripped a second time. So, for T, two operations are required, one to open the shutter and a second to close it. This contrasts with B, at which setting when the shutter release is pressed, the shutter will remain open just as long as you maintain pressure on the release. When you let go, the shutter closes. Use of the letter B in this connection is a throwback to the old days when, for this purpose, all cameras were equipped with a bulb and tube. Today this has been supplanted, on all amateur cameras at least, with what is called a "cable release" which operates the shutter by means of a fine wire plunger. Using T, we can trip the shutter, walk away and leave it, and close it later when we wish to complete the exposure. Using B, we must maintain our pressure on the shutter as long as we wish it to remain open. B usually is used for exposures up to 10 seconds.

Certain cameras have B but no T. With these we can secure the T effect by the use of a special cable release which has a set thumb-screw on it. When we press the cable release the first time, we set the thumb-screw so that the plunger remains depressed and retains its pressure on the shutter release. The shutter will remain open until the thumb-screw is released and in this way we can secure a (T) time exposure with a shutter designed only for (B) bulb exposures.

It is absolutely necessary to co-ordinate the two factors we have mentioned: the aperture, which governs the amount of light you admit to the film, and the shutter speed, which governs the time during which you permit the light to affect the film. If you let in too much light for too long a time you will over-expose the emulsion, and it will become so dark that all the detail of your image will be blocked out. If you let in too little light for too short a time you will under-expose, the image will be too light, and much of the desired detail will not register on the film at all. Between these two extremes will be the correct exposure: the right amount of light admitted to the film for the right time, resulting in a good negative with a tonal scale that will produce the best results. Arriving at this is far more simple than would appear from any amount of description. For work outdoors the correct exposure—or at least one sufficiently correct for all average purposes—may be determined from a very simple chart. When working indoors under artificial light we urge the use of a good photo-electric exposure meter following standard procedures on page 47.

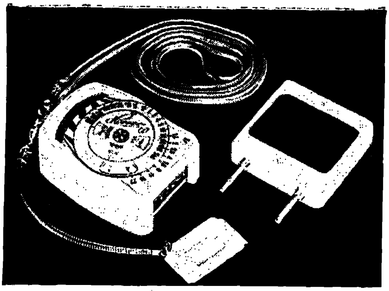
On page 40 we present an outdoor exposure chart of proven accuracy, by which we mean that when you follow it your aperture will be correct to within the small possible error of one stop. When you realize that ordinary black-and-white film has a latitude or leeway of three stops either way, you can see that the use of this chart will insure for you very good results. The point is that to take any picture we must know three things: the speed of our film, the shutter speed we should use, and the correct aperture. To simplify all this for the present, let us assume that we are going to use a film which has an outdoor speed of A.S.A. 80 and then let us standardize our shutter speed at once by setting the shutter at $1/100$ second. That takes care of two of our requirements and leaves us with only one variable or changing requirement—the correct aperture. This we shall determine by simple multiplication of the chart factors (the numbers at the top and sides of the chart). As these factors change, depending on the type of scene, view, or subject we propose to photograph, only the aperture will change; but since that will be all we will have to watch, our chance of error will be reduced to that one simple variable.

OUTDOOR EXPOSURE CHART

Film — A.S.A. 80 *Shutter Speed 1/100*	*Sunny* *(Very Bright)* *(4)*	*Hazy* *(Sun Obscured)* *(3)*	*Cloudy* *(2)*	*Dull* *(1)*
Marines (Wide Expanses of Water); Beach Scenes; Snow Scenes *(4)*	16	12	8	4
Outdoor Scenes; Landscapes with People; Buildings *(3)*	12	9	6	3
Average Street Scenes; People, Buildings, Etc., Open—Not in Shade *(2)*	8	6	4	2
Average Street Scenes; People, Buildings, Etc., in the Shade *(1)*	4	3	2	1

This chart, as already explained, takes care of our one remaining variable, the aperture, because we know the speed of our film and we are going to make all exposures with one shutter speed. We mentioned using a film with a speed of A.S.A. 50 and setting the shutter for 1/50 second. We may, if we prefer, use an A.S.A. 100 film and set the shutter for 1/100, or an A.S.A. 25 film with a shutter speed of 1/25. The aperture will still be approximately the same if we follow the chart. So, for your next step, look at your sky and your subject and decide in which of the four classifications each falls. Multiply the factor for (the number of) your subject by the factor for your sky and set your lens aperture accordingly. If, for example, you are photographing a beach scene on a sunny day, the factor for each is 4; by multiplying you get 16, and your aperture (your stop or F/number) will be 16. Do not be disturbed when, by multiplying as explained, your result is not one of the exact numbers indicated by the scale on your shutter; just set the lever or pointer to the spot on the scale which would approximate the desired number. You will not have used very much film before you will attain a feeling of complete confidence in this chart. At times the indicated aperture may look to your unpracticed eye like a considerable over-exposure, but trust the chart; it is far more accurate than your beginner's judgment.

BOTH REFLECTED OR INCIDENT LIGHT CAN BE READ WITH THE PHOTO-ELECTRIC EXPOSURE METER. A LIGHT AMPLIFIER CAN BE USED FOR VERY DIM LIGHT.



Once you have the chart down pat (and before long you will virtually have it memorized) you will soon learn how to manipulate the shutter and aperture so that, by using a wider aperture, you can stop motion better by means of a faster shutter speed or, when you want to get more of your subject into sharp focus even into the distance, do so by making the aperture narrower and using a slower shutter speed to compensate. For example, you admit the same amount of light to the film with an aperture of f/8 at 1/50 second that you do with an aperture of f/4 at 1/200, or f/16 at 1/10.

Let us return to the beach scene we spoke of. You are shooting a view down the beach on a bright, sunny day with A.S.A. 50 film, your shutter is set for 1/50 second, and the chart indicates an aperture of f/16. On another part of the beach a couple are playing ball and you want to include them in your second picture. You don't want their figures blurred; so you will have to use a faster shutter speed, and you think that 1/200 would be about right. That's four times faster than your original shutter speed of 1/50 and, to compensate for this and so that you will not under-expose your film by letting in far too little light, you make the aperture four times larger: you adjust the stop from f/16 to f/8. The same amount of light enters the camera and affects the emulsion on the film, but does it so much faster that you have stopped the motion of the two figures. That isn't so complicated, is it?

When working indoors under artificial light, where a chart is difficult to compile because of the differences in types and strengths of the reflectors in which the lamps are used, and also when making true color picture outdoors when precise judgment of the I–G–A–S Formula and exposure are essential, some kind of an exposure meter is necessary. The modern types which are based on the principle of using a photo-electric cell to measure the light are best. The basic theory of all such meters is the same. A mild electric current is produced when light strikes a selenium cell in the meter. This current moves an indicator in exact proportion to the amount of light striking the cell. The indicator moves over a calibrated scale on which are noted all the various factors which enter into the making of a negative: film speed, shutter speed, and aperture. Inasmuch as we always know from the manufacturer the speed of the film we are using, the indicator automatically tells us what we need to know with respect to the other two. If we have decided what aperture we want to use, it tells us the correct shutter speed; whereas, if we have predetermined our shutter speed, it tells the correct aperture. We need only abide by what the indicator advises and we will secure a negative within the capabilities of our film to record the varying tones of the scene or subject.

Using a photo-electric meter takes all the guesswork and rule-of-thumb estimating out of the making of exposures. Using a meter is commonly described as "taking a reading" and the result of such reading becomes a definite intensity number which can be duplicated at any place and at any time. Knowing our readings, we can duplicate any scene or subject months or years later and be sure that our resulting tonal values will be correct. By thus standardizing our lighting and exposure we can give full attention to whatever it is we want to express photographically. There are two methods for using an exposure meter. One reads the light reflected from the subject. The other reads the light which is falling on the subject, what is called the "incident" light, and such incident-type meters commonly have a hemisphere resembling half of a ping-pong ball covering the light cell.

The beginner will usually secure best results from the incident-type exposure meter because this white hemisphere smooths and evens out all the light before the reading is taken and thus simplifies the procedure very materially. When reading the light reflected from a scene or subject, the reflection-type of meter must be carefully shielded because it will react violently to any brilliant ray of light, such as that from a spotlight for example, and the reading will be incorrect. For that reason experienced users of reflection-type meters customarily take several readings with the meter, of the light reflecting from different parts of the subject being photographed, and then average the readings. An easier method is to use a Gray Card (available at your camera store by that name). The gray color has a known reflecting value and a reading from it usually gives the correct exposure setting.

However, regardless of the type of meter we are using, we must always maintain the ratios of our I–G–A–S Formula. The meter will assure us of a mid-point exposure factor which will correctly record our tonal scale within the limitations of the emulsion, but the proper balancing of our lights, so as to make the widest use of the film's latitude in securing the specific lighting effect we want, must remain a function of intelligent judgment.

In brief then: always expose fully; always maintain your I–G–A–S balance; simplify your camera manipulation for the present by using one type of film and one shutter speed so that the aperture remains your only variable; select the aperture according to the chart when working outdoors or by meter when under artificial light. Stick to this until it becomes second nature; then you are ready to let other considerations enter the problem.

CHAPTER 8 / INDOOR LIGHTING WITH FLASH

The reader is of course familiar with the everyday type of incandescent lamp: a glass bulb containing a fine filament which glows when an electric current is passed through it and thus produces light. It is possible to concentrate in just such a bulb an enormous volume of light which will be available for a small portion of a second. Such a light is called a flash and such bulbs are called flashbulbs. The authors like to think of them as containing "bottled sunshine." Originating in Europe, they are available here under two general names: "Photoflash"—the product of General Electric, Westinghouse, Solar, and others; and "Superflash"—the product of Sylvania. They are made in different sizes and types to produce flashes of varying strengths, varying durations, and varying color values. There are three main types of these bulbs: Class M, filled with fine aluminum wire or foil which, when current enters the bulb, ignites in about 1/50 second with a very brilliant flash of short duration; the Class F, containing prongs tipped with a rapidly combustible material which, when ignited by the current, permits a flash of about 1/200 second, and the class FP, a MUST for the Exakta's focal plane shutter if pictures are to be taken at 1/1000 second. These lamps are specially made to burn longer than the other two lamps. The duration of their flash can be pictured as a level plateau instead of a high peak. The plateau permits a uniform exposure throughout the entire travel of the focal plane shutter.

Another source of "bottled sunshine" is the flashtube, also called electronic flash or speedlight, which is set off by current from a power pack. Flashtubes, somewhat similar in shape and appearance to flashbulbs, are produced by a number of manufacturers and are many times more expensive initially than the few cents you pay for a flashbulb, but the flashtube is good for 10,000 or more flashes. Such lamps are filled with an inert rare gas such as Xenon, and when the current passes through, the gas glows with terrific intensity for a time which, depending on the make and type, will be no longer than from 1/1000 to 1/5000 of a second. The light is so strong, however, that this very brief light is ample for all purposes. While a flashbulb may be used in any type of lamp, or even in an ordinary home fixture such as a bridge or table lamp, the flashtube requires rather expensive accessory equipment and the beginner accordingly will do well to use flashbulbs until he has mastered his lighting fundamentals.

Any type of flash lighting must be synchronized to the opening of the shutter, which means that by some mechanical means the latter will reach its widest opening when the light emitted by the bulb or tube is at its strongest.

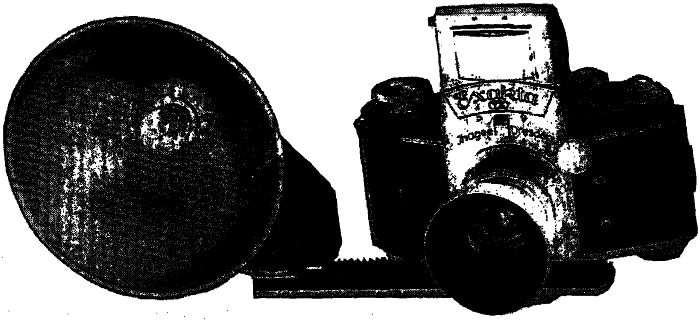
All models of the Exakta are provided with internally synchronized standard sockets for the ready attachment of battery-type flash guns. Inasmuch as they are internally synchronized, the gun itself may be one of very simple design because no solenoid (magnetic synchronizer) or other mechanical co-ordinating mechanism is necessary.

Focal Plane Flash—All Speeds

With the focal plane contacts, the Exakta uses certain types of bulbs specially designed to provide a long horizontal peak of light, such as—to mention the best-known makes—the Photoflash (General Electric or Westinghouse) #6 or #31, or the Superflash (Sylvania) #40, #26FP, or #2A. Guide numbers for the use of these bulbs will be found among the tables and charts at the end of this book.

Regular Flash

Class F and Class M flash lamps can be used with the electronic flash contacts at speeds of $\frac{1}{25}$ second or slower.



D. C. FLASH.

Speedlights—Flashtubes

If it is desired to use flashtubes (more commonly called "speedlights"), unless you have either the Exa or the Exakta V you will have a synchronizing problem, inasmuch as the speedlight flash is of only $\frac{1}{5000}$ second duration and its discharge is immediate. The shutter must be set only at $\frac{1}{25}$ or $\frac{1}{50}$ second. The Exa and Exakta V, VX, have built-in internal synchronization for flashtubes—the two sockets at your right when the camera is held with the lens facing you for the V, and the lower pair of black sockets for the Exa. The 1956 model only has a single socket for flash and another single socket for electronic flash.

With the Exakta I and II, flashtube synchronization is possible by having them built in for internal synchronization. Ask your dealer. They usually are adjusted for one specific speed and used only at that speed. The most satisfactory speed is $\frac{1}{25}$ second, because then the slit in the shutter curtain is at its full width and a hand-held exposure is still possible.

"Synchronization," as the term is used in photography and as you will no doubt have gathered by now, is the adjustment of flash and shutter so that the peak of the flash coincides with that fraction of a second when the shutter has opened the lens to the full diameter. In the case of the Exakta, the shutter opening is a slit which travels across the film frame. Thus synchronization could be an enormously complicated matter had the manufacturers not already provided for it in the design of the camera.

Latest information on flash synchronization is obtainable by writing to the Exakta Camera Co.

Color Work

The modern flashtube holds great promise for the future. In order for the flashtube to be acceptable for serious work, the delivered power must be considerable, else it will be regarded as a toy. With color film, the indicated minimum number for Kodachrome should be around 50. These numbers are fully adequate for the usual needs of both amateur and professional. For color work, both flashbulbs and flashtubes require the use of special filters over the lights in order to adjust their color temperature to that for which the color film is balanced, all of which will be duly explained. You will also learn that ordinarily a single flash at the camera is not sufficient to yield a plastic, tonally balanced picture. In most cases, two or more lights should be used, so whatever flash gun you select should have provisions for extensions enabling you to use the multiple flash technique when your subject requires it. We'll explain the proper placement of the lights later.

Extension Flash. While we are speaking of "multiple flash," which refers to the discharge or firing of one or more bulbs or tubes at a distance from the camera in addition to the one at the camera, under certain circumstances the distances between lights may be as much as 50′ or 100′. Under such conditions, placing the wires becomes not only an involved procedure but a considerable chore. To avoid all this, units called "slaves" have been designed. Operated by photocells (better known to the public as "electric eyes") these, when properly adjusted, will fire their respective bulbs or tubes simultaneously with the flash at the camera, being automatically actuated by it. Typical of photography's modern marvels, they make it possible to solve with ease lighting problems which, only a few years ago were thought to be hopeless.

With the multiple flash technique, and thanks to the short focus of your Exakta lens, you will find you can secure great depth of field without having to stop down as much as would be necessary with a lens of longer focal length. As an idea of the relative stopping down necessary to secure the same depth of field, let us point out that a 2″ lens at f/4 will have the same depth of field as a 4″ lens at f/8 or an 8″ lens at f/16. This demonstrates the inherent advantage of the short focal length lens. Also, while the depth of field is the same for the sizes mentioned, the exposure for the 8″ lens will require 16 times as much light!

Flash Exposure

Exposure for flashbulbs and flashtubes has been solved in a very simple manner. All manufacturers have established for each size and style of flash a number which is called the flash exposure guide number. Knowing this number, you need only divide the distance of your *I*llumination light from your subject (the I light of the I–G–A–S formula) into the flash guide number. The result will be the aperture you should use—the correct stop—the f number. For example, let us assume the film you have in your camera has a flash guide number of 160 for shutter speeds up to 1/50 second with a certain flash, and that your *I*llumination light has been placed 10′ from your subject. Dividing 10 into 160, the result is 16, and consequently you set your lens for F/16. If the *I*llumination light is 20′

away, divide 20 into 160, the result is 8, and your aperture will be f/8. If you standardize on one size and style of flashbulb or flashtube you can quickly figure out the proper aperture for all the distances in feet at which you are likely to be making pictures, note the information on a card, and eliminate such figuring for the future.

Most of our pictures, of course, will be made with more than one flashbulb or tube, but this is not going to complicate matters at all if we only keep in mind our I–G–A–S formula and remember that the strength of a light varies in proportion to the square of its distance from the subject. Suppose we want to make a portrait indoors with flash illumination and intend to use four flashes, all of them having the exposure guide number of 160. We place our *I*llumination light at the 45–45 angle recommended in Chapter 11 and at a distance of 5′ from our subject. Dividing our 160 guide number by 5 we get a result of 32; so we set our lens at F/32. We have already set our shutter; so all that remains is the proper placement of our remaining lights. The ratio of our *G*radation light to our *I*llumination light is to be 1 to 4—in other words it is to be ¼ as strong. Therefore it must be twice as far from the subject and we place it 10′ away. Next our *A*ccentuation light, probably a spot, is to have a ratio of 4 to 1 when compared with the *I*llumination light; we want it to be four times as strong. Therefore it must be only half as far from the subject and we place it at a distance of 2½′. Finally, our *S*eparation light to be thrown on the background must be equal in strength to the *I*llumination light and must therefore be as far from its respective subject (the background) as the *I*llumination light is from the sitter. We place the *S*eparation light 5′ from the background. All our lights are then in balance and will produce the desired differences in tonal quality. It's as simple as first grade arithmetic. There are times when, working outdoors, we may want to supplement the daylight with some artificial lighting. All we need to know is the correct exposure for the sun as our *I*llumination light; we can then readily place a G, A, or S flash, or any combination of the three, in order to balance our picture properly for the best results.

With the I–G–A–S Formula, the explanation of any problem becomes a matter of mathematical logic rather than verbal juggling. It will continually weave throughout our photographic experience and will be the key with which we can unlock any lighting problem, whether daylight, flash, or flood (to be explained in our next chapter). In connection with the use of flash it must be remembered that the time element involved in the synchronization of shutter opening and the peak (strongest part) of the light is very minute, and therefore every mechanical factor involved must be in proper order at all times. Batteries must be fresh and fully charged; all connections must be tight; bulbs should be checked and properly inserted in their sockets; all parts of the synchronizing mechanism must be clean and uncorroded. When working with color, proper color shields and correction filters must be used. One can never be too meticulously careful when working with flash.

Photoflood Exposures

Exposures can be estimated by a set of guide numbers similar to those given for flash-exposure. Otherwise, an exposure meter can solve your problems of correct photoflood exposure.

CHAPTER 9 / FLOODLIGHTED INDOOR PICTURES

This book, by its very nature, cannot pretend to be a complete manual of photography, which has so many aspects that numerous books have been, and are constantly being, written on each of the various manipulations and processes involved in the making of a finished photograph. For that reason, although there are still other types of lighting, we are limiting ourselves to those most commonly—and most easily and inexpensively—available to amateurs. Having discussed the use of flash, which we termed "bottled sunshine," we now come to photoflood lighting, equally well described as "condensed sunshine."

Photoflood lamps, produced by the same firms whom we mentioned as manufacturers of flashbulbs (photofloods made by Sylvania being called Superfloods), are incandescents generally similar to those you use at home for ordinary lighting purposes and much like them in appearance except for being somewhat larger. While the flashbulb generates a tremendous amount of light for a very brief time, the photoflood produces less light but for as long as you wish to keep the lamp burning, and while the life of a flashbulb is only a fraction of a second, that of a photoflood will be several hours, depending upon size and type. Consequently, because they are reasonably priced and need not be changed after each exposure, they are the ideal type of lighting for the amateur. Like flashbulbs they are used in reflectors so that the light may be directed as desired, but whereas flashbulb reflectors are all much alike in design, with reflectors of rather flat curvature in order to produce a broad light, photoflood reflectors vary greatly. Because the photoflood's usable volume or strength of light depends so largely on the reflector being used, it is a far more difficult matter to calculate by means of guide numbers the proper aperture or F number to use, than it is with flashbulbs. Consequently, while the I–G–A–S Formula applies as it does with any form of lighting, we advise the use of an exposure meter, such as already mentioned, for determining correct exposure and I–G–A–S balance.

The procedure will be the same as before, using a film of known speed and a shutter speed such as recommended. Place your *I*llumination light first and then your others, assuming that you are using—at least for this first experiment—photofloods that are all alike. The G, A, and S lights, should you decide that you need any or all of them in addition to your I light, will be placed at distances indicated by the ratios of the Formula. Then take a reading of the light on the subject with your meter and set your stop accordingly.

For ordinary black-and-white photography, photofloods may be mixed with and used in connection with other light sources, such as ordinary incandescents or fluorescent tubes, although, until you have become more experienced, the different strengths of other lights will complicate your following the Formula unless a meter is used. Only when working with color film is it essential to limit yourself to one pure type of light source. The chief advantage of the photoflood, which is of course made specifically for photographic use, is that because of its construction it burns with a light intensity three times that of a normal incandescent of the same size, while consuming the same amount of current. So, for its size, it does "condense" a lot of light. Photofloods are numbered and the higher the number the greater the strength of the light and the more current the lamp will draw. Therefore, when making pictures in the home, you should never attach reflectors carrying more than six No. 1 photofloods, or three No. 2, to any one circuit. If you do, you may blow the fuses or run the danger of starting a fire.

One disadvantage of photofloods is that they generate a lot of heat, which can become a matter of considerable discomfort to the sitter when you are making a portrait. Various devices (usually called "Hi-Lo" switches) to minimize and correct this drawback are obtainable. By means of electrical switches and relays, these reduce the amount of current entering the lamp so that it burns dimly while you are arranging the lighting scheme and only reaches full brightness when you flip the switch just before the actual exposure is being made. When using such devices it is well to have the lights synchronized to the shutter, as is the case with flash, because the sudden increase in intensity of the light will cause the sitter's eyes to blink and the actual exposure must be made just before that reaction. With flashbulbs and flashtubes the flash of light, although much greater in intensity, is over and gone so rapidly that the sitter hardly notices it, and if he does, he has no time to blink until after the exposure has been made.

Even with Hi-Lo switches the constant dimming and then brightening of the lights can become not only painful to the sitter, but psychologically disturbing. An easy way to avoid this is by a technique called "bounce light," which is really nothing more than the use of indirect light reflected from other surfaces so that none of it, or at least not enough to be troublesome, reaches the sitter.

To do this we place our *I*llumination light in a suitably deep, pan-shaped reflector and direct it toward the ceiling, thus converting our ceiling into a gigantic reflecting surface. Because we shall be losing much of the light we would otherwise be concentrating on the sitter, we use a stronger photoflood for this, a No. 2 instead of a No. 1. To balance this with our *G*radation light, we use a reflector of similar type, place in it a No. 1 photoflood, and direct this second reflector toward the floor. The ceiling acts as a more powerful reflector because it is uncluttered and usually lighter in color than the rest of the room. If we take a meter reading from only the ceiling (I) light, placing the meter on the floor, we will find that the strength of the light falls away very greatly. Therefore we must balance the I light with a G light as described. If an *A*ccentuation light, a spot, is necessary, we can direct it from behind the sitter and still avoid disturbing the sitter with any glare. Our S light, illuminating the background, will not be directed at the sitter in any event. Using a fast film, one with a speed of A.S.A. 80, we can make exposures at 1/10 to 1/25 second with a stop of F/3.2 under such a lighting arrangement. In the spot (A effect) we would have another No. 1 photoflood and by using a common professional trick we can employ a much smaller lamp for our S light, placing it in a small reflector on a low stand directly behind the subject. The light thus will be very much closer to the background and, being concentrated, an ordinary 100-watt incandescent may be sufficient.

With such an arrangement we have no light shining directly on our sitter and we eliminate the glare and heat which so often cause fidgeting or a strained appearance of the eyes and thus complicate our task of securing satisfactory pose and relaxed expression. We still use our basic I–G–A–S Formula and, as we grow in experience, we learn how to modify and adapt it so that we can get fully balanced pictures without the handicaps that result from direct frontal lighting. Have in mind first a general idea of the pose you want; place your I light; basing your ratios on that, place your remaining lights; take your reading; and there you are. It becomes merely a matter of the different lamps you are using and the types of reflectors and stands in which you place them, plus an appreciation of what actually happens to the volume and intensity of the light as you move the reflectors back and forth, up and down, or turn them to different angles. With each problem, our accumulated knowledge will, by now, correctly guide us to a logical and easily thought out solution.

CHAPTER 10 / MAKING PICTURES IN FULL COLOR

We have withheld the subject of color photography to this point, before we go into the matter of processing our negatives and the resulting prints, because it is important yet presents more technical difficulties if good pictures are to be produced. While color promises to be, eventually, the most important field of photography, it requires of the practitioner a broad, firm photographic background. In black-and-white work, as we explained, although the available emulsions are limited in their brightness range, there is still a permissible variation of three stops in either direction with respect to the amount of light entering the camera. In other words, even a fairly material error in exposure will not prevent us from getting a reasonably satisfactory negative; while even after the exposure, errors may be corrected by means of manipulation during processing and through the proper choice of a printing paper. With color we face a different situation. All our procedures, commencing with the exposure, must be far more precise. At most we may err in exposure to the extent of one-half stop over or under or, in processing, to the extent of one-half a degree in the temperatures of some of our solutions.

In addition to balancing our lights in accordance with the I–G–A–S Formula (Chap. 11) we have a very important additional factor to consider in that the color temperature of our lights must all be the same and that their color temperature must balance to the color film being used. In shooting a color picture all of our lights may be properly balanced as to intensity, but if we try to mix daylight (which has a color temperature of 5900° K.) and photofloods (3400° K.), our resulting picture will not have the actual colors of the original. It may, in fact, vary from the true colors so seriously as to appear ridiculous. Even it we blend floodlight (3400° K.) with standard incandescent lamps (3200° K.) the difference of 200° K. between them, which may seem very small, will be enough to throw our picture off in color balance. We mentioned this matter of "degrees K." in an earlier chapter, but might go a little farther and explain that these high figures represent the amount of heat, plus 273°, required to raise the temperature of a black metal body from what is known as red heat until it glows white. This absolute temperature was first discovered by Lord Kelvin and the use of the letter "K." is science's method of commemorating his name, just as the letter "F." commemorates Fahrenheit, who invented the first mercury-in-glass thermometer.

The chief reason for being more careful when working with color is that once our exposure has been made, there is practically nothing we can do later to correct errors, similar to the processes of intensification and reduction which can so easily be applied in the processing of black-and-white materials. If we are working with Kodachrome or any other color film which must be sent to the manufacturers' laboratory for processing, it then becomes part of an automatic chain of operations with little or no chance for individual manipulation. The same is true of Anscocolor and Ektachrome, both of which can be processed by the user. Therefore we must have everything we want, and just as we want it, on the film when we make the exposure. That is why from our very first chapters we have stressed the importance of correct procedure. If that has been understood and followed with respect to black-and-white, we now have nothing to change or learn over again when working with color. We still focus and expose correctly after being careful to match our light source to the film's color balance. Our highlight to shadow ratios hold true within the 4-to-1 rigid color limit. In planning our lighting set-up whether we shoot outside in daylight or indoors with artificial light, so long as we keep within those fixed ratios we will get sparkling and properly balanced color pictures. We must always light the subject for the color effect we want on the film, and not as it may appear to our eyes. In time the worker in color will develop a sort of "color sense." It will be easiest to learn from the grandest color expert of all—Mother Nature. Landscapes, in general, are always in correct color balance. So, from our outdoor work alone, we can gradually discover those blends of colors which, in a finished picture, will be most pleasing to the eye.

When working with color film we will learn from the carton or instruction sheet that it is balanced for 5900° K., which is in most localities the equivalent of clear sunlight between 10:00 A.M. and 2:00 P.M. At other times of day, or when sky conditions are different, we shall have to use special light filters to change the color temperature of the scene so that it balances with that of the film, or our colors will not be truly rendered. Now we can begin to see how complicated color can become if we do not understand what lies behind the instructions we are asked to follow. Because many amateurs do not understand and perhaps therefore do not consider the instructions important, many of them secure relatively poor color results and tend to blame either the maker of the film or the manufacturer of the camera for failures which are actually their own.

On page 56 we list a few of the special filters used when working with color film but, to simplify matters and avoid—at least at the beginning—the necessity for carrying around an assortment of filters, we advise that you familiarize yourself thoroughly with respect to one specific set of conditions and take color pictures only when those conditions are present. Until you are sure of what you are doing, limit yourself to the use of one color filter and take pictures only when no filter is needed or when that one filter will handle such corrections as are required. Later, as your experience grows, you can buy and use others.

When using flash for color work outdoors, where our fill-in light must have the same color temperature (5900° K.) as our daylight, we can use blue lamps, standard flashbulbs if they have first been tinted blue in any of several dyes made for the purpose, or fasten over the flash reflector a shield of a blue color. Either will automatically change the color of the Type M or Type FP flashbulb to match the temperature of the daylight. But such a fill-in light of the correct color temperature is a must. Results without it will show severe shadows, either inky black and without detail or depth, or with untrue colors. But to repeat, because most flashbulbs burn at 3800° K. and our daylight is 5900° K., we must compensate for that difference of 2100° in the color temperature, and so use either a blue bulb or a blue shield over the reflector.

Always keep in mind that dull, unbalanced lighting can yield only dull colors. Whether working indoors or out, make certain to throw enough light into your shadow areas, and this applies regardless of the type of light you may be using. Darkness being an absence of color, if you have dark areas in your composition, you will have no color, or at best incorrect color, in those areas in the finished picture. With properly controlled lighting, indoors or outdoors, following the I–G–A–S Formula, our lighting will be brilliant and our colors will sparkle. Only by constantly trying to bring out brilliant, sparkling colors can we fully reap the benefit of the modern miracle—color film.

FILTERS FOR USE WITH COLOR FILM (NOT BLACK-AND-WHITE)

Film and Color Temperature	*Color Temperature or Type of Light Being Used*	*Increase (x)*	*To Correct, Use Filter:*
Kodachrome, Daylight Type (5900° K.)	Floodlight (3400° K.)	2½	#80
	3200° K.	2½	#80 plus #82-A
	Haze, outdoors	—	#1-A
	Ultra-violet	—	#2-A
Kodachrome, Type F (3800° K.)	3400° K.	1⅓	#82-A
	Outdoors (sunlight)	1½	#85-C
	Type M Flash (3800° K.)	1⅓	none
	Type SF or SM Flash	1⅓	#82-A
Anscocolor, Daylight Type (5900° K.)	Floodlight (3400° K.)	4x	#10 plus #UV-15
	3200° K.	4x	Conv. #10
Anscocolor, Indoors (3200° K.)	Outdoors (sunlight)	1½	Conv. #11
	Floodlight (3400° K.)	—	#UV-15
	Type M Flash (3800° K.)	—	#UV-16
All color films	Daylight or Tungsten: To reduce glare; correct haze; deepen color; increase contrast	2	Polarization screen

CHAPTER 11 / LIGHT—AND THE I-G-A-S FORMULA

An understanding of how light affects a sensitized photographic film is the cornerstone of all successful photography. We must realize that differing strengths of light produce varying reactions on the film and that, because of this fact, an image in a varying range of tones becomes possible. The film contained in the roll or cartridge which you buy from your dealer is a strip of transparent cellulose acetate, one side of which is coated with a light-sensitive solid gelatin silver salt solution, called an "emulsion." This emulsion is literally saturated with microscopic grains of silver in sensitized chemical form.

The truly remarkable thing about these grains of silver is that they turn dark when struck by light; what's more, how dark they become depends on the strength of the light that reaches them. In the chemical processing which is explained later, the darkness of the affected grains becomes permanent and those which were not touched by light are washed entirely out of the emulsion. This processing is necessary because, without it, the moment we exposed the film to light to see what we had photographed all the remaining grains would turn dark and the image would vanish, the film becoming practically black all over. So, to produce an image on the film we must first have light and, to retain only the image, we must use chemical means—developing and fixing.

The point to remember is that we must have light—and light in various amounts which we shall call "ratios" from now on—if we are to produce a worth-while picture with our camera. *No light—no image—no picture!* With this fully understood, our equipment becomes a secondary matter. If we know how to control the light we can take any camera and produce a good picture. If we do not understand, or disregard, this all-important control of light, not even a camera costing a thousand dollars will produce a worth-while picture. This understanding of the control of light in the production of good pictures is the key to full enjoyment of this wonderful combination of art and science—*photography*.

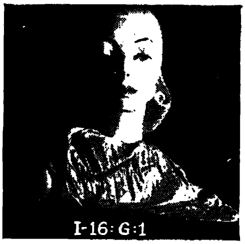
Despite the continuous advancements being made in photography, the photographic film cannot record in one picture the complete range of shades that is seen by the human eye. The eye can see, and actually distinguish between, some 2000 light differences or shades of light in one scene. In other words, the eye has a light range of approximately 2000 to 1. For practical purposes the photographic film provides us with a usable ratio of only 16 to 1. Nevertheless that ratio is ample so far as the production of satisfactory, and even the finest, photography is concerned. If we try to capture a greater ratio of bright to dark, we will find either that our dark tones are hopelessly inky black and without image detail, or our highlights are chalky-white and detailless. For practical work in black-and-white or color, our workable ratios of bright to dark will in general be about 4 to 1. By this we mean that the bright, or highlight, side of our subject may receive four times as much light as the dark or shadow side without exceeding the capacity of the film (really the emulsion that is on the film) to record the light. Since the film cannot record all the light variations seen by the eye without losing detail in either the bright or dark portions, we must always carefully balance our lights within the film's low limitations. To simplify this matter of assuring the proper lighting ratios between the component parts of a picture, we have coined what we call:

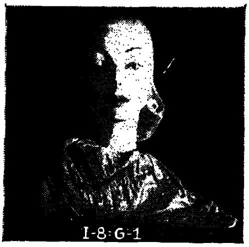
The I-G-A-S Formula:

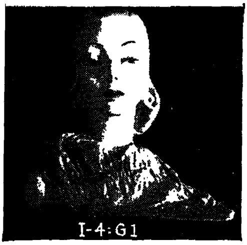
I—Illumination
G—Gradation
A—Accentuation
S—Separation

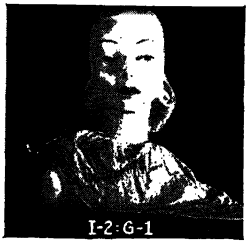
This, and it is in no way complicated, enables us to break down and recognize the four essential factors which enter, in greater or less degree, into the lighting of every picture, indoors or outdoors. Now to describe these factors in their order of importance.

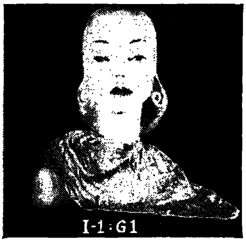
I—Illumination. To record any scene or object on a photographic film we must have light, and first of all we must have one general light source over our subject which will let us see what we are doing. The professional photographer usually speaks of this as his "main source" or "modeling" light, and because every picture must begin with some such basic or key light, this light is going to become our reference point for figuring *all* following ratios as well as our exposures. This *I*llumination light (outdoors it will be the sun; indoors it may be a photoflood or whatever) may be directed at our subject from any angle and from any direction but, when

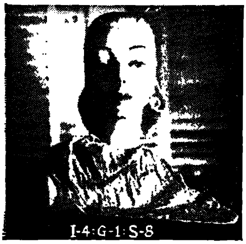

I-16: G:1

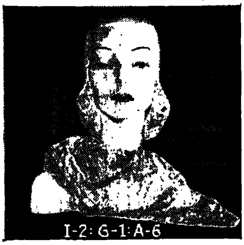

I-8: G-1


I-4: G 1

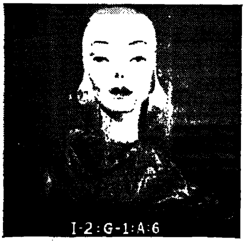

I-2: G-1


I-1: G 1

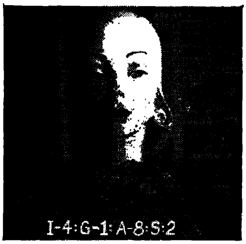

I-4: G-1: S-8


I-2: G-1: A-6

ACCENTING SCARF


I-2: G-1: A 6

ACCENTING FOREHEAD


I-4: G-1: A-8: S:2

using artificial light, it is better not placed at the camera because there it tends to minimize detail and texture. The best position of this light for revealing texture (and skin has texture just as much as materials) is at a 90° angle from the camera. For most purposes a compromise safe and standard *I*llumination angle is the 45–45 light. This means that the light, stand and all, is first placed at a 45° angle from the camera and that the reflector in which the lamp or bulb is housed is adjusted so it is at a 45° angle to the subject and is then directed downward toward the subject again at a 45° angle. Assuming that we have thus properly placed the *I*llumination light we will find that the side of the subject facing the light will be quite bright while the side away from the light will be in severe shadow. (*See the illustrations.*) Although our eyes can see detail in this shadow we know that because of the limited sensitivity of the film this shadow will photograph practically black. To photograph this shadow side with proper detail we must bring additional light into the area in order to raise the ratio of bright to dark so that it is, at least, within the minimum sensitivity of the film's 16 to 1 ratio. This brings us to:

G—Gradation. This additional brightness in our shadow side is produced by what the professional calls his "fill-in" or "balance" light, and it may be provided either by reflection or by the use of an additional lamp. Reflection of the *I*llumination light from a wall, an open book, a newspaper, a mirror or a white sheet of cardboard, may be sufficient to bring up the ratio of the shadow area to usable proportions. Failing a suitable reflector we can use another lamp, but its intensity—or strength—must be only a fraction of that of our original *I*llumination light. Remember in this connection that the strength of light varies in proportion to the square of its distance from an object. When you move a lamp two feet away from an object you reduce its intensity one-fourth; if you move it two feet closer you increase its intensity four times. Thus it is entirely possible to use for your *G*radation light one just as strong as your *I*llumination light, provided your *G*radation light is sufficiently far away. For practical purposes we can say that portrait photographers when photographing men use a ratio of 4 for the *I*llumination light to 1 for the *G*radation light, 3 to 1 for brunette women and 2 to 1 for blondes. Maintaining proper ratios between these two lights will retain our detail while giving us the full, open shadows so desirable for portrait, salon, or commercial photography.

While a subject may be properly lighted so far as *I*llumination and *G*radation are concerned, we may find that one portion of our composition (our general arrangement) requires more emphasis than another. In a portrait this might be the forehead, a cheekbone, or the hair. In a commercial picture or still-life photograph it may be necessary to "snap up" some one item or an entire part of the picture. And so we come to:

A—Accentuation. For this purpose a spotlight is generally brought into use because it provides a crisp, concentrated, and powerful light which can easily be controlled over a limited area. Again remembering that the film is insensitive to small changes in the ratio of light, we realize that the *A*ccentuation light must be several times as strong as the *I*llumination light—three times is about right, a 3 to 1 ratio. Spotlighting the hair in a portrait may add sparkle and sheen, an accent of light on a forehead may help to denote character; these and many other accents which may be added to a photograph—provided all is kept in character—will add materially to the final effect. Once again the ratios of I, G, and A in our formula to the limited latitude of the film are prime ingredients for the full understanding of the photographic action of light. But there is one thing more: our photograph must also have depth or it will have no life. To provide this necessary depth we come to our fourth factor:

S—Separation. Photography is the representation of three-dimensional objects upon a flat surface. Yet no good photograph ever looks flat. There must be definite depth and separation of the subject planes. In a portrait the head and body should appear to stand out from the background. In a commercial shot the subject should give the impression that one can reach into the picture and take hold of it. And all this is accomplished by *S*eparation. If we are shooting outdoors, then our *S*eparation is merely a matter of judiciously selecting a contrasting background that will not seriously conflict with our subject or view. If our subject is a person we should avoid posts, bushes, and other objects which may later seem to be sticking out of the figure, or the blatantly horizontal lines of a clapboarded or brick wall. If we are photographing a building, we should try to select a view which will not include in the background anything against which some important part of the structure may be lost.

But what interests us chiefly here is the attaining of this very important *S*eparation by means of light, and since we are discussing the use of controlled artificial light (of whatever type or kind), it follows necessarily that we are working indoors and there must be something in the way of a background behind our subject. If this background is improperly lighted, we can ruin our picture in one of two ways. Either the subject will seem to have been cut out and pasted against the background—a lack of depth—or parts of it will be lost in the background ("merged into it" is the common term). Dark hair or clothes may appear as a muddled mass against a dark background while light hair and clothes may merge into and be lost against a white background. We must, therefore, balance our background light in order to assure this *S*eparation.

By now it should not be too difficult to estimate the correctly balanced ratio of the light on the background. First let us realize that even if our background is a pure white wall, or screen, or sheet, we can render it in any shade from white to black in the finished picture. If it receives no light, it will reflect no light to the film, and will photograph black. (*See the illustrations.*) If we throw half as much light on the background as the strength of our *I*llumination light, in other words if our ratio of light on the background is 1 to ½, the background will of course be in shadow as compared to the *I*llumination light on the subject, and the background will photograph gray. If we build up our light on the background until it is equal in strength to our *I*llumination light, our white background will photograph white. If our background (*S*eparation) light is more concentrated and thus stronger than our *I*llumination light, we can produce a spot effect on the background. Knowing our film latitude and understanding the ratios in our formula, we can control the tone of our background to assure exactly the desired amount of *S*eparation.

Thus the interweaving and balancing of the ratios in the I-G-A-S Formula make the picture. Choice and variation are limitless, permitting the personal touch so necessary for individual interpretation and treatment. Knowing what to do makes the how-to-do-it far easier. No longer are we dependent on any one camera, set of lamps, or time of day. Some pictures may require only one light source, sun or lamp; for others we may need four or more. Neither the number nor the type are of importance; it is only how we make use of them that counts. The camera, no matter how completely it may be equipped with gadgets (or lack them), is now only important as a light-tight film-holder awaiting our judgment as to the exact moment to click the shutter and admit to the film the light which we have already planned in the manner best calculated to assure us a really good photograph.

CHAPTER 12 / PROCESSING THE NEGATIVE

Having made enough exposures to complete the roll of black-and-white film which you had in your camera, you are ready to remove it for processing. Although you have exposed to light the sensitive silver salts in the emulsion which is on the film you would still see no image on it were you to look at it immediately. Although the image is there, you first have to blacken chemically those silver salts which were affected by the light, this being that part of the processing known as "development." Then during the second process, which is called "fixing," you make them permanent so that later exposure to light will not fade the image away, and at the same time you wash out all remaining unaffected salts. Having removed the film from the camera you then, in total darkness, re-roll the film into a light-tight tank. One of the many such tanks on the market is illustrated here. All are accompanied with detailed instructions which are quite simple to follow and once you have rolled the film safely into the tank and replaced the cover you can finish your work comfortably in the light.

The list of chemical agents which will develop a photographic negative is long, indeed. The claims made for special concoctions of individual "soups" (pet term of professionals for their developers) are even longer. After being guilty of years of experimenting with every newly announced "wonder soup," both manufactured products and "home-grown" formulae, we have these to offer as our considered recommendations: 1) Do not experiment. 2) Implicitly follow the recommendations of the manufacturer. His sole aim is to provide you with formulae that will work. If you do not get the expected results, re-examine your own shortcomings. The manufacturer cannot gamble or experiment. What he tells you must be so, or you will not continue to buy his product. He gains only by correctly advising you how to get the most and the best from what he sells you.

After a period of many years it is not surprising to find that the two formulae still most in use are those which under all conditions have been found to produce the most uniformly good results, two basic formulae generally known as D-76 and DK-20. Both may be bought in powder form, requiring only simple dissolving in water, and thus are foolproof. Because their use in this manner is so easy and time-saving we do not recommend that you buy the separate individual chemicals and mix your own solutions, although both formulae are stated here in detail so you may understand of what they are composed should you prefer to mix your own. One more point to remember: when a developing solution has been used once, a certain amount of the solution loses its strength. Rather than compensate for this by leaving the next roll of film in the developer for a longer time (and the time of development is every bit as important as the proper chemical composition of the solution), use one of the different-strength solutions called "replenishers." The addition of the specified amount of replenisher after the development of each roll of film returns the developer to full strength so that the developing time remains the same. Of course this cannot continue indefinitely, and after a certain length of time the developer becomes exhausted and an entirely new solution must be started.

Because the 35mm negatives produced by your camera are quite small you will want to use an enlarger to make your finished prints. There are two types of enlargers, "diffusion" and "condenser," and when working with the diffusion type a negative of greater "contrast" is required. By contrast we mean, not a greater scale of tones, but a sharper delineation between the blacks and whites of the negative. Securing the desired contrast is merely a matter of controlling the length of time the film is left in the developer; and therefore, following each of the formulae, we state the recommended developing times for films of various speeds for both diffusion and condenser types of enlargers. The recommended developing temperature at all times is 68° F., which means that in cold weather the developer must be warmed to that temperature, and in hot weather cooled accordingly. All sorts of juggling is possible with both development temperatures and developing times, but this only introduces added possibilities of things going wrong. If the beginner can get into the habit of following recommended procedures at all times, the chances for error will be lessened.

When we expect to require a considerable later degree of enlargement, and therefore know in advance that we shall be using the DK-20 developer in order to get a very fine grain, the lens stop used for the exposure should be increased by a third to a half, because to secure this finer grain we must make some sacrifice in our film emulsion speed.

Returning now to the roll of film we have placed in our tank, into which latter we have poured the required amount of whatever developer we are using, let us assume we have left the film in for the specified time. Were we to remove it from the tank at this point and look at it in the light we would see that portions of the film are black and others yellowish in color. Then, before our eyes, the yellowish portion would also turn black, forever ruining the film. To prevent this overall blackening we leave the film in the tank, carefully covered, while pouring out the developing solution into its own distinctly labeled bottle, and then pour into the tank either plain water at 68° F., or a solution of 1 ounce chrome alum acid dissolved in one quart of water. This is called using a "short-stop" and, as the name implies, the purpose is to stop any further action of the developer at that point because of course some developer remains in the emulsion. The short-stop remains in the tank for one minute only and is then poured out, no light being permitted to enter the tank. Finally we pour into the tank what is called a "fixer" or fixing bath, also at 68° F. This, the "hypo" as it is commonly termed, dissolves out the remaining unnecessary and unactivated silver salts which still remain in the emulsion.

Incidentally, fixing baths, like developers, can also be bought in package form so that weighing and mixing are eliminated and

ACID HARDENING FIXING BATH

Water at about 125° F.	600 cc
Sodium thiosulphate (Hypo)	240 grams
Sodium sulphite, desiccated	15 grams
28% acetic acid	48 cc
Boric acid crystals	7½ grams
Potassium alum	15 grams
Water to make	1,000 cc

D-76 DEVELOPER FOR FINE-GRAIN, MODERATE ENLARGEMENT

Formula (D-76)		*Replenisher (D-76R)*	
Water at 125° F.	750 cc	Water at 125° F.	750 cc
Elon (Metol)	2 grams	Elon (Metol)	3 grams
Sodium sulphite, desiccated	100 grams	Sodium sulphite, desiccated	100 grams
Hydroquinone	5 grams	Hydroquinone	7 5 grams
Borax, granular	2 grams	Borax, granulated	20 grams
Add cold water to make	1,000 cc	Add cold water to make	1,000 cc

Use at 68° F. Add one ounce of replenisher following development of each 36-exposure roll of film.

Recommended developing times:

A.S.A. Film Speed	*For Diffusion Enlarger*	*For Condenser Enlarger*
16–25	9 minutes	7 minutes
32–50	13 minutes	9 minutes
60–100	16 minutes	13 minutes

DK-20 DEVELOPER, EXTRA FINE-GRAIN, FOR VERY LARGE ENLARGEMENTS

Formula (DK-20)		*Replenisher (DK-20R)*	
Water at 125° F.	750 cc	Water at 125° F.	750 cc
Elon (Metol)	5 grams	Elon (Metol)	7 5 grams
Sodium sulphite, desiccated	100 grams	Sodium sulphite, desiccated	100 grams
Kodalk	2 grams	Kodalk	20 grams
Thiocyanate (pot. sulphocyanate)	1 gram	Thiocyanate (pot. sulphocyanate)	5 grams
Potassium bromide	½ gram	Potassium bromide	½ gram
Add cold water to make	1,000 cc	Add cold water to make	1,000 cc

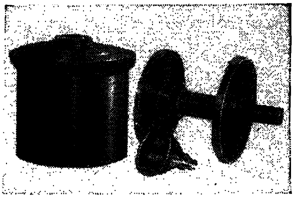
Use at 68° F. Add one ounce of replenisher following development of each 36-exposure roll of film.

Recommended developing times:

A.S.A. Film Speed	*For Diffusion Enlarger*	*For Condenser Enlarger*
16–25	12 minutes	10 minutes
32–50	15 minutes	12 minutes
60–100	18 minutes	15 minutes

you need only add water, and this we recommend. The film is now left in this solution for 10 minutes, or double the time it takes to clear the yellowish cast from the emulsion. Whenever the fixing time becomes excessive—say as much as 30 minutes—the solution should be discarded and a new one substituted. When fixation is completed. the fixer is also poured into a distinctive bottle for future use. Right here we should warn you to mark all your bottles plainly so you will not inadvertently pour developer into fixer bottles or vice versa, which would of course ruin either for future use, not to mention any films which you might attempt to develop or fix in such contaminated solutions.

After approximately 10 minutes in the fixer you may look at the film and if the lightest areas are completely clear and transparent the film is ready for washing, which should be in clear running water as close to 68° F. as you can maintain it, and for a good half hour. The film, which is now a finished strip of negatives, may then be hung up to dry in a clean, dry, draftless room. This procedure will give you clean, dust-free negatives thoroughly suitable for printing or enlargement. The tones, as you already know, will be the reverse of those of the original subject. Restoring the tones to their correct relationship can be done by various processes: contact printing



DAYLIGHT FILM DEVELOPING TANK

enlargement, slides and the like, each giving a different effect. But, for superior quality in the finished result, the negative must be of the highest standard, which means proper I–G–A–S exposure of fresh film, plus correct development, short-stop, careful fixation, and thorough washing. Make the entire procedure an established routine from which you do not depart and you will not only eliminate errors but assure yourself of the maximum in superb film tones.

CHAPTER 13 / PRINTING AND ENLARGING (PROCESSING THE NEGATIVE)

When we process the negative, an image results which is completely reversed in tone to that of the original subject. To correct these tones so that we may finally represent what our subject really looks like, we must reverse the tones of the negative. This we can do in one of two ways. We can place this negative in physical contact with another emulsion of sensitized silver salts (customarily on paper although it may be on film, glass, or even other materials), which is called "contact printing," or we may place the negative in an apparatus which enables us to pass light through the negative and project the rays to our second sensitized surface at a distance, which is called "enlarging" or "projection." By then processing this new emulsion we secure an image which is the reverse of the negative—a positive which matches our original subject. To accomplish this we shall need as a minimum a contact printing frame or an enlarger; trays in which to manipulate our developer, short-stop and fixer, a darkroom lamp and a white low-watt bulb, and an audible timer which will count off the seconds. We shall devote this chapter to the production of positives on paper. The most common developer is of the D-72 type:

Universal Paper Developer

Water at 125° F.	500 cc
Elon (Metol)	3.1 grams
Sodium sulphite, mono	45 grams
Hydroquinone	12 grams
Sodium carbonate, mono	79 grams
Potassium bromide	1.9 grams
Cold water to make	1,000 cc

To use, dilute 1 part to 4 parts of water for bromide papers, 1 to 2 parts of water for chlorobromide, and 1 to 2 parts for chloride papers. (These are the names of various types of emulsions, and the packages are always marked.) The time of development will be 60 to 90 seconds at 70° F. If you are going to make only a comparatively few prints at a time, it is advisable to buy the prepared packages which merely require the addition of water. Just as was the case when processing the negative, after developing the paper it must be immersed briefly in a short-stop and then thoroughly fixed, and suitable formulae for both follow:

Short-Stop Formula

Acetic acid, 28%	45 cc
Water to make	1,000 cc

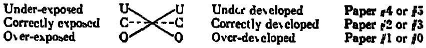
After development, rinse the paper in this for at least 10 seconds and then place in the fixing bath:

Acid Fixing Bath for Papers

Water	1,000 cc
Sodium thiosulphate (Hypo)	240 grams
Sodium sulphite, desiccated	30 grams
Acetic acid, 28%	90 cc

This should always be used fresh and the paper should remain in it for not more than 10 minutes, after which it should be washed for at least half an hour in constantly running water. For a glossy finished effect squeegee the print with a print roller, emulsion side down, on a polished metal plate. These, called "ferrotype plates," are of steel with a highly polished surface of chromium or other metal, and the process is known as "ferrotyping." Leave the print on the plate to dry until it comes off by itself. For a dull or non-glossy effect such as provided by the papers with surfaces called "matte" or "semi-matte," wipe off the surplus moisture and place the print between blotters to dry, with a weight on the blotters to keep the print flat. If you have an electric print dryer, put the emulsion side of the print to the metal surface for a glossy result and to the apron side for a matte finish.

Although we may have maintained as perfect control as possible in producing our finished negative, we still may not have attained perfection. To allow for this eventuality the manufacturers offer us printing papers of various grades—"latitude" is the term—which have emulsions of narrower or wider scales from white through gray to black, all based on the assumption that a perfect negative will produce the best result if printed on a #2 paper. Thus, any of the following sins of omission or commission might have happened and we can compensate for them by using a paper of the grade or number indicated: Our negative might have been:



The implication is that unless we are always certain of producing perfect negatives we must have on hand at least three or four different grades of paper. One manufacturer has found a way to overcome this complication by making an enlarging paper the grade of which may be changed by the simple use of variously colored filters which are placed over the enlarging lens. Some 14 or more different grades are made available to us by the use of just this one paper. To the beginner, then, this offers considerable advantage because it simplifies matters, and also because, having only one paper in stock, he will use it up more rapidly with less chance of its growing stale.

To make a print by contact, placing the printing-frame face down before us, we lay the negative on the glass with the emulsion side facing us. Over this we place the sheet of printing paper, emulsion side down so that the two emulsion sides are in contact. The emulsion side of the negative is dull, that of the paper is shiny, and they are quite easily recognized. On top of the paper we put the back of the printing-frame and clamp it into place. Now we "expose" the paper, which means that we hold the printing-frame up to a soft, weak, diffused light, at a measured distance, for a specified interval of time. You will find full instructions on a sheet in the package of paper. After we turn off the light the paper is removed from the frame, developed, rinsed, fixed, and dried, the procedure being the same as with the negative except that now we use our solutions in separate trays instead of one following the other in a tank. If we have followed instructions we shall have a print showing the subject in its correct tones and our chief disappointment will be the very small size of the print, which of course can be no larger than the negative. For this reason miniature contact printing is little used today. However, such a contact print does serve as a record of the negative and may be helpful for comparing tone values and subject matter required for proper enlargement.

It is enlargement from these tiny negatives that brings out the full, real enjoyment to be had from this wonderful combination of art and science. Since almost anything can be done, and almost nothing (photographically speaking) is impossible, with enlarging, it is small wonder that this method of making prints has come to be regarded as the playground which gives full freedom of expression to the photographic amateur's imagination and intellect. With an enlarger the handicap of size is overcome because we can project the print to any size we can handle with our equipment. We can, if we wish, project and then print from only selected portions of a negative so as to condense and sharpen our center of interest. We can combine the best portions of several negatives to obtain unusual effects. Naturally then, offering all these possibilities, enlarging is virtually a science in its own right.

There are two general types of enlargers. The diffusion type breaks up and scatters the rays of light which pass through the negative and is therefore generally preferred for portraiture as it minimizes any minor blemishes. The condenser type, by optical means, throws a beam of crisp, nearly parallel light rays through the negative and results in a wire-sharp, clean image; it therefore calls for practically perfect negatives. In deciding which type to buy we should remember that we can still produce a soft effect with the condenser enlarger by diffusing through a screen, while there is no way to produce a truly sharp image with a soft diffusion enlarger.

Having placed the negative in the carrier, with paper of the proper grade on the easel and our image properly focussed, we are ready to expose for our first print. The correct exposure immediately poses a problem. There is no easy, push-button short-cut to correct exposure. We must use test strips, more test strips, and still more test strips. If we do not, our perfect negative, which could give us an ideal print, may be completely nullified by our sloppy technique. So, to find our correct exposure, we cut a strip from one of our sheets of paper and, at regular intervals on that strip so that the result will be a staggered set of exposures, we expose for 5, 10, 20, 40, and 80 seconds. Then, with our various solutions at 70° F., we develop, rinse, and fix that strip. Before we examine it under white light we make sure that all of our remaining unexposed paper is in a paper safe or in a lightproof wrapping.

An examination of the successive exposures on this first strip will tell us the approximate exposure and we then take a similar strip of paper and break up the approximate time into another set of smaller staggered intervals. If, for example, the first strip indicated that the most suitable exposure was in the 5 to 10 second bracket, we expose the second strip for 5, 6, 7, 8, 9, and 10 seconds. Again we develop, rinse, and fix. This second strip should give us our correct exposure on the nose. Perhaps it indicated that the correct exposure should be 8 seconds. We expose a full sheet of paper for that time and process it. We then have the complete image, properly exposed, and can tell whether the negative was properly balanced or not. If not, we may have to hold back portions of the negative by "dodging," i.e. shading them from the light during part of the exposure; or re-enforce other portions by giving them additional exposure—"burning-in," as it is termed. This requires covering the balance of the negative during part of the exposure so that the "burnt-in" portion will receive more of the light. All of this testing and experimenting may have to be repeated half a dozen times before we get an acceptable print, but we will find it the most interesting and absorbing part of the entire process of making a photograph.

The more we advance, the more care we will take to secure a truly acceptable print. An amateur will print 30 or so prints an evening, come what may. An advanced worker may be satisfied if he realizes one truly fine picture in a week. Picture excellence always reflects the care and painstaking skill of the worker. Despite photography's continual advancements and simplifications, there probably will never be a substitute for judgment and intelligence. For art's sake, let us hope not!

CHAPTER 14 / AFTER TREATMENT OF PRINTS

We may have performed every step of the way to this point—exposure, processing the negative. printing or enlarging—with the greatest of care and strictly in accordance with instructions, and yet because photography at best can be only a mechanical imitation of the human eye, our final print may not produce the exact effect we desired. Even so, it may still be manipulated or corrected as was the case with the negative. Although a print can be intensified, the danger of permanently staining it is great and we do not recommend this method. It is far easier to make a print which is much too dark and then lighten (reduce) all or part of it to secure the result we wish. There are three things we can do in the way of reducing a print.

First, we may wish to lighten large areas. We place the print, thoroughly fixed and washed, face up on the back of a large tray, or on a sheet of glass, handy to a source of running water. Next we need some of the Farmer's Reducer previously mentioned. Dip a wad of cotton in the reducer and with a constant circular motion apply it for a few seconds to the areas of the print which require lightening. Wash the print in running water. Repeat until you have brought the areas to the desired tone. Remember that the solution accelerates rapidly in action so that care and patience are required to avoid a sudden ruinous bleaching out of the image. This method is useful for snapping up the brilliance of clouds, lightening large shadow areas, etc.; but you must exercise moderation and patience.

Our *second* method is "local" treatment, for toning down very small areas such as dark spots and dots. Use a fine sable brush, twirled to a fine point as previously explained, and dipped in the reducer. Apply it to the spot, allow a few seconds for the reaction, and wash in running water. Repeat as often as necessary, but be careful not to leave the reducer on too long for the reasons mentioned above.

Third is "overall" reduction, useful when a print has a generally foggy (dark) cast. Such a print can be snapped up to proper brilliance by the use of a very dilute solution of the reducer, a solution with enough water added until it has a faint lemon color. Immerse the print in this for 10 seconds and wash in running water. Repeat as before.

Thus Farmer's Reducer will take care of a variety of dark print problems. However, there may be white spots or white areas on our print which need correction. Then we resort to what is known as "spotting," best done with a charcoal pencil. First touch up the larger white spots, then the smaller ones, finally the pinholes. If it is necessary to darken areas larger than spots, we can either use special dyes made for the purpose or, shaving some of the lead from the charcoal pencil, rub that into the print with a wad of cotton.

Another type of after-manipulation, called "toning," should be mentioned before we close this chapter. It is possible, by still another set of chemical processes, to tone our black-and-white print into varying shades of sepia or brown, blue, green, red, etc. Toning may either add to, or (improperly done) subtract from, the final result. Given a suitable subject, toning will enhance its mood and effect. Used generally and unjudiciously, toning may cheapen our pictures. Only with proper use will it become one more interpretive addition to our bag of tricks. Most sepia toning solutions have a highly unpleasant odor because they generate hydrogen sulphide, a smell much like that of rotten eggs. Here is a formula which is odorless:

Solution A:	Potassium ferricyanide	12 grams
	Potassium bromide	12 grams
	Water to make	1,000 cc
Solution B:	Thiocarbamide	6 grams
	Caustic soda	12 grams
	Water to make	1,000 cc

The first requisite is a properly fixed and washed black-and-white print which in itself has a fine scale of tones because we are now only going to change it from black-and-white to sepia. The finished print may be a bit darker or lighter, if we wish, but there will be no alteration in relative tonal values. Place the print in Solution A until the image disappears—bleaches out. Remove and wash until the print is entirely clear. Then immerse in Solution B for about 2 minutes, whereupon the image will return in a sepia color. The longer the print remains in B, the darker the image will become. When the desired tone is secured, wash the print well, and dry.

Once more, before we leave the subject of processing and after-treatment, let us again urge the use, at least for the occasional worker, of prepared formulae in ready powder form. Not only does this insure freshness and strength of all solutions but it also saves money because waste is lessened, saves the time of handling and weighing chemicals, and—more important—eliminates one possible source of grief: the inaccuracy of an entire formula through the misweighing of just one of the chemical constituents. Perhaps the reader will now realize why a finished print, made by a prideful worker, requires so much work. Snapshots can be turned out by machinery but pictures have to be made by conscientious hard-working individuals. Constructive, sincere effort, which is its own reward, permits of no short-cuts.

CHAPTER 15 / COMPOSITION AND INTERPRETATION

Before closing this part and proceeding to the more specific uses to which you may desire to put your camera, we feel we must devote some space to two topics on which many books have been written, and the first of these is "Composition," without which an otherwise technically perfect picture will leave both the maker and those who look at it with the feeling that something is lacking. Naturally we cannot, in this limited space, go into great detail, but if you want to make pictures that will be more than mere records of what your eye sees, we urge that you buy a good book on composition and study it carefully. *Image Management* by Nicholas Haz is one that will help you and is, in addition, entertaining reading, which many such books are not.

Briefly, we can say that composition is the art of making a picture interesting. In practice, it involves a knowledge of the proper balance of light, shade, and space; the balancing also of the various elements that go to make up the picture; and the suitable arrangement of its directional lines. Good composition serves only one end: the presentation of the subject in the most pleasing manner. Over the years certain laws of composition have become accepted as necessities and perhaps two of the most important are the avoidance of too many horizontal and vertical lines and the too even dividing of the picture area. Verticals and horizontals, for one thing, are static and uninteresting.

It may be required, for certain commercial purposes, to photograph the direct front of a building, for example, smack in the center of the picture space, straight up and down and with no effect of perspective. But if we want to make a picture that will give the observer a better appreciation of that building—that, in other words, will hold his interest—we shall photograph the building from one side or the other so that, while the verticals will remain correct and the building will not appear to be leaning over or falling backward, it will have a three-dimensional effect and the horizontal lines will depart from that static direction and slant away into proper perspective.

Similarly, photographing an individual, we may take a straight front view with the head directly in the center of our picture space, but the result will be merely a map of the features—a rogues' or shooting-gallery likeness. To avoid this we move the camera so that there is more space to one side of the head or figure than the other;

we turn our sitter somewhat away from the camera and turn his head toward the lens. Again we have broken away from the tiresome and tedious pure vertical and horizontal and have substituted diagonal lines and a broken spacing, lending our portrait interest and action. The variations of the two themes we have so briefly discussed are limitless, but this serves to give you an idea because in each case at least an attempt has been made to follow two of the basic rules of composition.

To appreciate this the more, look at some of the advertisements in the magazines you read. What catches your attention—a straight-front shot of a refrigerator or some household appliance or of a model wearing a dress or coat, or another picture of a similar subject which gives you the feeling that you can see all around the object or model, which has a background that adds interest, which has a harmonious treatment of the light and shadow areas? You may not, heretofore, have understood why the one appealed to you more than the other, but the difference is solely a matter of composition.

Verticals and horizontals, we repeat, are static and boring. Diagonals, angles, and curves keep the eye in motion and thus add interest. An even division of the picture area prevents proper emphasis of the center of interest, and every good picture must have such a center of interest. One simple way to secure what is called compositionally "dynamic balance" or "dynamic symmetry," is to divide the picture space mentally into thirds, both horizontally and vertically. Imagine that lines have been drawn across your space in that manner and then locate your center of interest at one of the four intersections of those lines. Immediately your composition derives movement and vitality. If you will just bear in mind this simple rule of breaking up your picture space into thirds, you will be on your way toward acquiring a sense of good composition.

Only a short step forward from composition is the additional feature of "Interpretation" which, unless added to our two earlier requirements of correct technical processing and good composition, may still leave our picture lacking in some respect. We have selected a subject and have carefully planned our composition; we know—let us hope—that we can produce a perfect negative and print. How shall we interpret that subject; how shall we present it to those who will see the finished picture in a manner that will cause them to appreciate or understand the subject as we do? We can scale our tones within any range and any portion of the highlight or shadow area. We can decide, in setting up our lighting, which set of ratios under the I–G–A–S Formula will most satisfactorily meet our desires, and whether results will be better with natural light or artificial—if the latter, whether to use flash or flood. We can add materially to the mood and effect through our choice of printing paper, and still more through proper selection of the most appropriate surface and stock, because all papers come in a wide variety of finishes. We can lighten or darken various areas of the picture space while enlarging—"dodging," this is called. In addition we can tone the processed print and perhaps thus more clearly emphasize the idea we are trying to convey. Finally we can add our own touch of individuality by judicious mounting and an attractive signature.

Each of these steps has a definite bearing on the finished result, and not until you have experimented with all will you appreciate the infinite possibilities of even one single negative. Avoid a rut. Try different processes, methods of toning and print control. Make one print on a paper with a canvas surface and another on a silk finish—the variation will surprise you. It is useless for us to write and for you to read—unless you try for yourself. Only when you blend and fuse all these factors in a manner to express your full thoughts can you truly say: *"I have made a photograph!"*

CHAPTER 16 / FILTERS—THE COLORMASTERS OF LIGHT

We have already told you that the emulsion on a photographic film does not have the same range of sensitivity to light as the human eye. There is another essential difference which we must now discuss and that is the subject of "chroma," or sensitivity to color. While the normal human eye can see the full range of colors in the spectrum there are no photographic emulsions which exactly duplicate the eye's sensitivity to colors or combinations of colors. On the other hand, it is possible to make emulsions which are sensitive to subvisual rays of light which the human eye cannot see at all—for example, by the use of infra-red light and suitable filters, photographs can be made on emulsions sensitive to such light in total darkness. When such a film is processed, we see what closely approaches a normal image.

Most film used for black-and-white photography is over-sensitive to blue light. Consequently with an otherwise normal exposure outdoors, a sky that looks quite blue will come out a bald white on the final print. As we have already told you, the white light which we find all around us is actually made up of rays of light of all colors. You can prove this, as we have said before, by throwing a ray of light through a glass prism, whereupon it will break up into the different colors of the spectrum. With a suitable projector this process can be reversed: all the colors of the spectrum can be combined and the result will be white light.

By the use of what is called a "light filter" we can control the composition of the light that enters our camera. The light filters most commonly in use are gelatin sheets or plates of dyed glass which come in a wide range of tints and colors, in holders of different sizes and styles which may be bought to fit over the fronts of all lenses. Such a filter will permit certain colors to enter the lens and reject others and so, by the use of the proper filter, we can bring the color sensitivity of the film into balance with the sensitivity of the eye. Thus properly balanced, the various colors and shades which we see will, when rendered in black-and-white on the finished print, have the same intensity with respect to each other that the original colors have to our eyes. Similarly it is possible to select filters which will reject all colors except a few, thus deliberately over-correcting and unbalancing a negative when we want to secure dramatic or unconventional results.

There are a great many filters on the market for use with black-

and-white film and many others for use with color film. For black-and-white work the filters listed below are those most commonly used with films intended for average photography, such as those we named at the top of our chart of film emulsions in Chapter 10: Plus-X, Supreme, Superior 2, and the like.

The proper use of filters when working with color film requires a separate section and will be fully discussed when we come to color. We must, however, mention here still another type of filter which has nothing to do with color at all, but is called into play solely to control reflection or glare. We might call it an "anglemaster" rather than a colormaster because its purpose is to permit only rays of light approaching at a certain angle (usually 33½°) to enter the lens. Technically, this control of light is called "polarization" and the filters are best known under the name of "pola-screens." For such purposes as reducing reflections from metallic objects, cutting sky glare, or cutting water reflections, they are extremely useful. In many types of work, such as reducing glare for color film to increase color saturation, they are essential.

FILTERS IN EVERYDAY USE

Color Being Photographed	*To Lighten*	*To Darken*
Violet	C-5	B
Indigo	C-5	B
Blue	C-5	F, A, G or B, K-2
Green	B, G, X-1 or X-2	C-5
Yellow	G or A	C-5
Orange	G or A	C-5
Red	F, A or G	C-5 or B

Obviously, whether you are using a light filter to keep certain colors out of the camera or a pola-screen to keep out the rays of light from certain angles, you are cutting down the amount of light which enters the lens. It then logically follows that if you have calculated the specific exposure which you think is required, and you then put a filter in front of your lens, that exposure will be wrong because less light would be entering and therefore a longer exposure will be necessary to compensate for the loss of light. However this is quite simple because for each filter there is a number or factor and all you have to do is to multiply the original exposure by the filter factor. When you buy a filter, its factor is printed on the box or on an accompanying instruction sheet; so we are not going to attempt to offer in our limited space anything like a complete list of filters and their factors. We shall list a few here to give you the general idea and at the same time tell you the typical uses of these particular filters. The letters "D" and "T" refer to daylight and tungsten as in our earlier table of film speeds and other information.

A good rule-of-thumb to remember for filter factors is that a K-2 (Yellow) has a factor of 2; G (Orange), 3; X-1 (Green), 4; A (Cherry Red), 5. The polarizing filter, with its factor of 2, may be used in combination with other filters and when so used its factor doubles the factor required for the other filter. So an X-1 and a polarizing filter, used together, would require a factor of 8. Properly used, filters enhance a picture either through more correct color rendition or by contrasted dramatic results. *But never over-filter.* Selection of the proper filter with careful judgment permits proper interpretation of tone, and this individual treatment is one of the bases for successful photography.

FILTER FACTORS AND WHAT FILTERS ACCOMPLISH

Filters	*Factors*		*Uses*
	D	*T*	
K-2 (Yellow)	2	1.5	To darken blue skies; produce normal skin tones; increase certain color intensities so they approximate effect caused on the eye.
G (Orange)	3	2	To overdarken skies; produce dramatic contrasts; often used for architectural effects.
X-1 (Green)	4	3	To lighten foliage; effect separation of trees from grass, etc.
A (Red)	5	4	To blacken skies; produce night effects in daytime.
Polarizing	2	2	To eliminate glare and haze; darken skies without change of color.

(Both the K-2, used outdoors, and the X-1, used indoors, serve to correct tones so they approximate the intensity of colors on black-and-white film as they appear to the eye.)

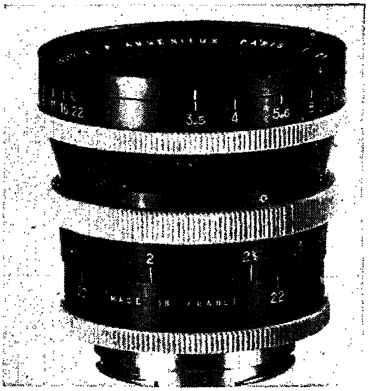
CHAPTER 17 / WIDE-ANGLE AND TELEPHOTO LENSES

Photography, as you will well appreciate long before you have finished reading this book, is at best a series of compromises because it is an attempt to reproduce by mechanical means the marvelous achievements of the human eyes. This matter of compromise is, of course, most true of the lens, that complex aggregation of glass and air spaces which, on the camera, substitutes directly for the eyes. No lens has yet been designed, and almost certainly none ever will be, that will completely duplicate what the combination of the human eyes, nerves and brain can accomplish in a fraction of a second with respect to adaptation to constantly varying depths of field, angles of view, changing colors, and strengths of light.

The 2″ Tessars, Biotars, and similar lenses which can be considered standard for the Exaktas come as close, with their 48° angle of view, to an all-purpose lens as any user can reasonably expect. Yet, as you progress in photography to what might be called the "advanced amateur" rank, you will realize that good as these lenses are, they do have their limitations. Your first realization that there are limitations will probably come when you shoot your first roll of color film. When you work with black-and-white, the resulting image may be cropped to improve or correct the composition, while any particular portion of it which you wish to emphasize may be enlarged. You will discover that when you work in color, each picture must be fully composed on the film frame and be taken correctly, because no later alterations can be made.

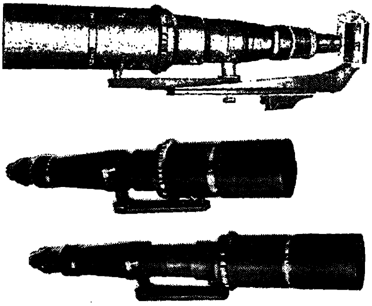
Exa Limitations. For the Exa, no 2″ lens wider than a F/2.8 or a focal length longer than 105mm can be used. The compactness of the design will otherwise cause the edges to vignette if these limitations are disregarded.

It is possible to vary the size of the image on the film frame, and without changing the position of the camera, but to accomplish this it becomes necessary to alter the focal length of the lens on the camera. Actually you cannot change the focal length of the lens itself, so what this amounts to is that either you add a supplementary lens so that the new combination of the two lenses has a different focal length or—and this is what you normally do with the Exakta—you merely substitute for the lens already on the camera a totally different lens of the desired new focal length. Due to the interchangeable lens feature of the Exakta, this is simple. To remove



(*Courtesy of Exakta Camera Co.*)

THE 28MM WIDE-ANGLE RETRO-FOCUS F/3.5 COVERS A 50 PER CENT WIDER AREA THAN THE STANDARD 50MM LENS



HEAVY TELEPHOTO LENSES REQUIRE MORE SUPPORT TO PREVENT PRESSURE ON THE CAMERA'S LENS MOUNT.

the lens, hold the camera facing you and press down the bayonet lever, which will release the set-pin that the lever grasps. Then rotate the lens to the left, maintaing a slight pull away from the camera, until the lens lifts easily out of its mount.

You can then replace your original lens with any of a truly great variety of lenses suitable for use with the Exakta. Because the Exakta does not employ the conventional type of range finder (with its attendant complication of cams, levers, and gadgets to insure that the viewfinder, rangefinder and focusing of the lens are all properly coupled), any lens can be easily fitted to the Exakta provided it has the necessary bayonet coupling device. This is true even though different lenses have different scales of focus. It is often possible to pick up as bargains excellent focusing lenses, standard on other cameras and sometimes highly desirable, and adapt them for use on the Exakta by means of only an extension tube and proper bayonet coupling or the Ihagee Versal.

When you do substitute another lens for the one which is standard on your Exakta, you do so for one of two reasons. Either you want to include a wider angle of view (in which case you substitute a wide-angle lens) or you want to secure a larger image (for which you substitute a telephoto lens), than your standard 2″ lens will permit *without* changing your camera position: To minimize con-

ANGENIEUX MANUFACTURES A LIBRARY OF LENSES FROM WIDE-ANGLE TO TELEPHOTO FOCAL LENGTHS. WITH THEM, PICTURES CAN BE TAKEN ALMOST ANYWHERE.

fusion in discussing the standard lens and these other lens, we offer the following terminology and descriptions.

Prime Lens: We shall use this term when speaking about lenses which are normally considered as standard for such cameras as the Exakta. It refers in general to a self-contained, whole lens of definite, fixed, positive focal length, and such lenses are of two types:

(1) *Non-interchangeable:* A lens affixed to the camera in such manner that it may not be replaced, which of course is not the case with the Exakta.

(2) *Interchangeable:* A lens that may be removed as a unit from the camera so that another may replace it, as on the Exakta. There are two types of prime interchangeable lenses:

(A) *Unit Focusing:* Such lenses are focused by moving the entire lens in the mount. This is the usual form.

(B) *Front-Cell Focusing:* Such lenses are focused by rotating only the front element. Front-cell focusing has its theoretical limitations, but where price and design are paramount considerations, it has been found entirely adequate as to results.

Telephoto Lens: These are lenses which, when substituted for the normal prime lens, produce a *larger image* on the film frame without the necessity of moving the camera, and such lenses are of two types:

(1) *Long Focus:* Any lens of longer focal length than required for proper coverage of the normal film frame area.

Auxiliary Compound Lens: Recently certain removable, multi-element lenses have been designed which, as their name would imply, are used in conjunction with the prime lens, being affixed in front of it. These also are of two types and should be used only with the 2″ f/3.5 Tessar at openings of f/5.6 or narrower, within which limitations worthy results may be obtained.

(1) *Auxiliary Compound Wide Angle:* Such lenses, when used with the prime lens, widen the normal field approximately 20%.

(2) *Auxiliary Compound Telephoto:* Such lenses, when used with the prime lens, cover a field approximately 20% smaller than normal, with the result that they yield a correspondingly enlarged image.

Supplementary Lens: Such lenses are of the single-element meniscus variety, made of one piece of glass with calculated concave (negative) or convex (positive) surfaces. Like the auxiliaries, they are used in combination with the prime lens and, when affixed in front of it, alter its focal length so that the infinity point must be brought forward by means of an extension tube (for negative lenses) or brought back by decreasing the lens-to-film distance (for positive lenses). They are of two types:

(1) *Negative:* In strengths —1, —2, —3, etc., under such trade names as Telek and Distar.

(2) *Positive (SP):* In strengths +1, +2, +3, etc., under such trade names as Portra, Proxar and Portrait.

Negative Lens Not *Practical.* On the prime lens of the Exakta it is possible to use a supplementary negative (SN) because we can separate the prime lens from the camera body and use extension tubes to bring the combination forward to its new infinity point. However, this remains only a theoretically optional procedure because it requires an SN with very strong negative curvatures (in order to secure a sufficiently large later degree of enlargement), an increased exposure, and an extension tube of extremely accurate manufacture.

Positive Lens Works Well. On the other hand, you definitely can cause a supplementary positive (SP) with your prime Exakta lens. While you cannot bring the prime lens back to its rear infinity point when fitted with an SP, because the resulting new combination (PI + SP) acts as if it were brought forward of the new infinity point, for close-ups you will find that you can focus on objects as close to the lens as 4″ (a positive +10 lens) through the use of the proper strength SP. If the PI + SP combination were brought back to infinity it would gain speed, and length of exposure would be decreased. But, because the combination really acts as if it had been brought forward, increasing the lens-to-film distance, the exposure returns to normal. Consequently, when using SP lenses, no increase of exposure is necessary.

Not until you have absorbed and put into practice at least part of what we have told you in Section II, will you really become thoroughly familiar with your prime lens, nor will you fully appreciate the value of wide angle or telephoto lenses as adjuncts to your equipment. However, a further discussion of their purposes and uses properly belongs in this chapter.

Wide-Angle Lens. Let us take up the wide-angle lens first, the one which increases the angle of view when it replaces the prime lens on your Exakta. There are very considerable advantages to be attained by adding a wide-angle lens to your outfit. It will make possible, for instance, such an increase in the angle of view that you can photograph much more of the interior of a room even when working in the comparatively limited space of the average apartment. To make this clear, let us say that what the wide angle will enable you to photograph under such conditions as could only be accomplished with your prime lens if you could perform the miraculous and back through a wall. Similarly, when working outdoors, the wider angle of view permits you to take a landscape in its full scope and grandeur instead of including only that smaller portion to which you are limited by the narrower angle of your prime lens. With the shortening of the focal length to increase the angle of view, you derive a still further advantage in that you gain a greater depth of field, which means that more of your image will be in sharp focus at the same F/ opening.

With the Exakta, the wide angle is very simple to use because, since you are viewing the subject on your hooded ground-glass or with the ortho prism through the same lens with which you are going to take the picture, you do not have to bother about specially attached compensating viewfinders or the like. You need only look at the subject as it appears on the viewing screen and shoot it. What's more, your depth of field can be read from a chart or from the depth-of-field scale on the lens. We suggest that you compare the scales on a 35mm or 28mm wide-angle lens with that on a normal 50mm lens, which will actually show you in figures what a difference the changed focal length can mean. Also, because the wide angle is a complete lens in itself (it is actually also a prime lens although of a totally different formula from that which is standard on your Exakta), it has its own iris and you set your lens openings on it in the customary manner.

Telephoto Lens. Now for the telephoto lens. While its increased focal length (which brings the infinity point of the lens farther away from the film plane) does decrease your field of view, that is more than compensated for because what the telephoto lens sees appears in larger size, which means a larger image on the film frame. This feature is helpful for portraiture, street scenes, distant landscapes and tall buildings, monuments or the like, sport shots, etc., as well as when you are photographing children at play or animals in action. Ordinarily you will have to get quite close to a subject if you want to secure an image of large size and even then, with your prime lens, some distortion will result. With a telephoto lens, which is available in varying focal lengths, your camera may be farther away and you thus secure better perspective together with greater freedom of action for both your subject and yourself. You will find a telephoto lens extremely valuable when you are working in color because so often you will want to photograph distant objects in larger size on occasions when you cannot approach any closer with your camera. As we have mentioned before, when working in black-and-white, such a distant object can be cropped from the negative and enlarged; but in color you are limited to just what your prime lens will produce on the film frame. As with the wide-angle, once you have substituted a telephoto for your prime lens, you are still both viewing and taking with the one lens and, therefore, you operate your Exakta just as you would with the prime lens on it.

Effective Use of Lenses. By adding both wide-angle and telephoto lenses to your outfit, you greatly expand its flexibility as well as your ability to add your own individuality of interpretation to each picture you take. With the camera at the same position, you can use your three lenses to tell a complete story. First, with the wide angle, you take a completely over-all view. Then a shot with your standard prime lens concentrates your composition. Removing that lens, you substitute the telephoto and with it you emphasize and enlarge the chief point of interest. This long, medium, and short (or close-up) technique is, incidentally, the core of all motion picture story-telling and, with practice, you can in this manner duplicate in still form the unusual effects you have so often seen on the screen.

CHAPTER 18 AVAILABLE LIGHT—BOUNCE LIGHT

Available light is the pure prevailing light that illuminates a scene. Regular street lights at night, auditoriums lighted artificially or by daylight streaming through transoms or windows, and artificially lighted homes are typical subjects lighted by available light.

Outdoor sunlight while still classed as available light presents no problems because there is so much of it. Available lighted pictures have come to mean pictures taken under dim prevailing light.

The renewed interest in available light pictures came about gradually because once upon a time most pictures were taken by natural light—the sun. The slowness of ancient films made exposures so long that photography usually was limited to still subjects; thus portraits usually wore expressions that were stiff, stern, and stilted because poses had to be held for minutes at a time.

The flashlamp era came next. Almost every picture was flashed. It was really so simple to do—mount the lamp on the camera, set, sight, press the button, and the result would be a perfectly exposed picture. However, a price still had to be paid for this simplicity. A flash picture, even though the exposure time was short, still had such faults as heavy shadows, burnt-up foreground, and black backgrounds. So the pendulum again changed direction and returned to pictures taken by available light. This time, all the factors were in favor of both the photographer and the subject because of the remarkable progress that had been made with sensitized materials and with equipment. Candlelight pictures could be made at 1/25 second at f/2.8 or narrower, depending on the film and developer in use. Now the pictures were no longer static. They are dynamic, natural representations of our work and our pleasures. However, while the photographic process is beautiful when you can take advantage of the infinite gradations that are possible, you must master some technique in order to make acceptable available light pictures.

Here's the way to make available light pictures that will have snap and sparkle:

Equipment. Your Exakta should have an f/2 to f/3.5 lens—the faster the better. Wider openings permit at least a 1/25 second exposure with dim light. A higher shutter speed will minimize hand held movement. This speed is a minimum because, while slower speeds may produce pictures that appear well when contact-printed, they "fall apart" when enlarged, because even the slightest bit of camera motion produces a blur on the blowup.

Film. Load the camera with Eastman Kodak's 35mm Tri-X film. Rate it at A.S.A. 400 when setting your exposure meter index, and plan to develop it in Microdol or D-76 for 16 minutes at 68°F. Tri X film also can be rated at an A.S.A. 2000 when developed in DK-50 for 15 minutes. An entire roll must be shot at one speed or the other—they cannot be mixed and developed separately. The built-in knife of the Exakta is valuable if only a short length of film is to be shot at a definite speed, cut from the roll, loaded into a developing tank, and developed separately.

Determining the Exposure. If sufficient light prevails to move the meter needle, then read the meter in the normal way. When, however, so little light is present that the meter needle does not move, then to determine the correct exposure becomes more of an art than a science. Experience can be the best teacher. If you have photographed pictures in a room lighted by 300 watts of light at 1/25 at f/2 and found the exposures correct, write this down for future reference. If a stage is lighted to an average brightness and produced a fine picture at 1/25 and f/3.5, then write this down. Should the stage be dark, then open the iris to f/2. Should the stage seem brighter than usual, then try f/4.5. Keep a permanent record of this information; it will be of inestimable value.

Development. The A.S.A. index at which the film is shot depends upon the developer which will be used. If the film is developed for an A.S.A. 2000, then DK-50 must be used. You must use DK-50 under this exposure condition; otherwise you will produce only a blank piece of film.

Taking the Picture. It is wise to leave as many factors alone as possible and use but one variable. As an example, try to leave your shutter speed at 1/25 second and change only the iris opening for darker or lighter scenes. This system works better with the Exakta because the slow speed dial must also be wound when making an exposure of 1/5 second or slower. The excitement while photographing action or dramatic events may make one forget to wind the slow speed dial and an underexposure will result. So settle on a uniform shutter speed and change only the iris opening.

Focus. The combination of automatic diaphragm and rangefinder prism is the best assurance of a sharp picture. Focus is made with the lens at its widest and the prism at its optimum efficiency, even though the light is dim. Lenses without automatic diaphragms or with pre-set diaphragms can still be used rapidly if the iris is set at the f/opening that will be used to take the picture. The rangefinder prism should be part of the camera for available light pictures because you can focus with its clear glass brilliance even though the ground glass is too dark to focus easily. Learning to use the rangefinder prism effectively can make it function almost as efficiently as if you had an automatic diaphragm.

Taking the Picture. Available light pictures are usually more dramatic than most pictures because of the contrasting sweep of tones from white to black. You must use every bit of technique that you possess to hold up taking the shot until the peak of expression or action is reached because $\frac{1}{25}$ second is still a relatively slow speed and can show camera and/or subject movement. The picture will be natural because the subjects move about normally, undisturbed by flashlamp flare-ups, tripping over extension cords, etc.

Bounce Light—Pseudo-Available Light

What Is Bounce Light? While the naturalness of available light pictures is most desirable, the difficulties of slow speeds, wide iris openings, coarse grained developers, etc., often reduces photographic quality. Many workers substitute wherever possible the light from a flood, flash, or speedlight that is bounced from a wall or a ceiling and reflected onto the subject. This light raises the light level of the scene so that $\frac{1}{25}$ second exposures can be made with finer-grained film at narrower openings than are usually used with pure available light. An average exposure with a #5, #25 flashlamp would be around f/8 to f/11; with a 50-watt second speedlight, f/4 to f/5.6.

What Is the Effect? The bounce effect simulates pictures taken with available light because the light bounced from a ceiling or wall bounces around the room and produces a uniformly lighted picture that simulates normal room light.

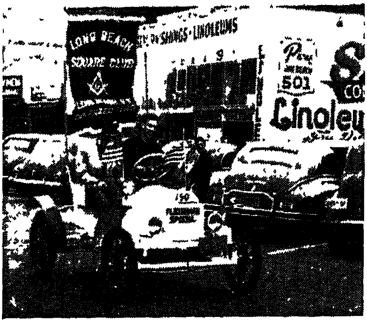
Bounce Exposure. Exposure, by a quick rule of thumb, is calculated by opening the iris two stops more than you would if the light were directed at the subject. As an example, the average home room distance from lamp to ceiling to subject is about 10 feet. A lamp with a guide number of 160 normally would require an opening of 160/10 or f/16. With bounce, the opening is widened two stops and the opening actually used will be f/8.

Development. The bounce effect usually is soft, well diffused. Contrast is low. For this reason, increase development to 20 minutes with Microdol to snap up the contrast of the negative.

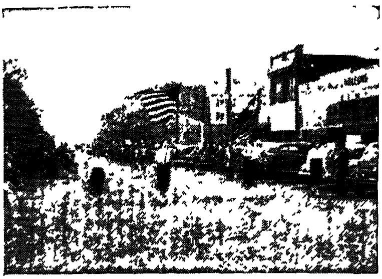
CHAPTER 19 / SPORTS AND ACTION SHOTS

Normally, when you are taking action pictures outdoors, you will be working with ample quantities of light, sufficient for you to use a shutter speed of 1/1,000 second in view of the fact that the Exakta's short focal length lens provides a tremendous depth of field even at such apertures as F/2 or F/2.8. Accordingly, you can set your distance scale at 84′ or 63′ (to suggest two appropriate depth-of-field distances) and know that at the former distance everything from 42′, or at the latter everything from 31½′, to infinity will be in sharp focus. This is a considerable advantage when shooting action because if for each picture you must first focus on the ground-glass and then shift your attention from focusing to the action itself, the shots you really want will almost certainly be lost while you are busy focusing. Instead, setting your distance scale as suggested, you can ignore focusing entirely and, with the Exa, Exakta I, or Exakta II, use only the sports finder or, if you have an Exakta V, use the ortho prism. You are then always ready to catch the moment of greatest excitement, the high point of the action: the batter as he connects with the ball, the runner as he breaks the tape, the diver as he enters the water, and so on.

Balance your Daylight with Flash. On the other hand, you may want to shoot action when the light conditions are not so favorable. Perhaps it is late in the day and the sun is already casting shadows across the subject or the area where the pictures must be taken; perhaps, and this is often the case except in those parts of the country which boast of their "eternal sunshine," the sky is overcast. It will then be desirable to increase the I–G ratio of your lighting formula to at least 4 to 1; in other words you will have to supplement what daylight there is with flash. The latter will have to provide your *G*radation light to fill in the shadows which your *I*llumination light (your daylight) is throwing at an angle. If you use your flash guide number incorrectly, without judgment, you will get an under-exposure, dark sky or background, and so you must first establish what your normal I exposure should be with the light as it exists.



STILL FOLLOWING THE PARADE



A MEMORIAL DAY PARADE

Let us suppose you decide that your I light concentration is such as to warrant an exposure of 1/50 at F/8. If the flashbulb you plan to use for your G light has a guide number of 160, then the flashbulb should be at a distance of 20′ from the subject. But, if your subject is only 10′ away, your indicated aperture will be F/16, whereas, if you expose with that aperture and with your flash at the camera, your whole lighting scheme will be upset. So, you do one of two things. Either you remove the flash gun from the camera and arrange for it to be set or held 30′ from the subject or, if it cannot be removed or you have no one present who can hold the flash at that distance, you can compensate by leaving the flash at the camera and cutting down the strength of its light.

This latter you can do quite easily by hanging one or more white handkerchiefs (or similar pieces of cloth) over the reflector of the flash gun. One thickness equivalent to a clean white handkerchief will cut the light in half—the equivalent of one stop; two thicknesses will yield one-quarter the normal amount of light—two stops; three thicknesses will let only one-eight of the light pass through—the equivalent of three stops. Finally, as in the situation we mentioned, four thicknesses will diminish the light of the flash to one-sixteenth of its normal strength—four stops. Consequently, with your subject at a distance of 10′ in strong daylight but with heavy shadows that you must reduce, and where you want to maintain a 4 to 1 ratio between your I (daylight) and G (flashbulb) lights; and where you are using a flashbulb with a guide number of 160 and exposure of 1/50 second, you hang four handkerchiefs over the reflector and you will have attained your desired I–G lighting balance.

Peak of Action. When attempting action shots in restricted, poor light and where no flash is permissible, as for example in a theatre or at the circus, when your lens must be wide open at F/2, or F/3.5, with only a shutter speed of 1/10 or at the most 1/25 possible, you can still get excellent results by timing your tripping of the shutter to correspond with the peak of the action or motion. Even in good light outside if, for example, you are attempting to photograph a child swinging, while you will get nothing but a blur if you expose during the middle of the swing. If you wait for a lull in the motion as the swing reaches its highest point—where it comes almost to a stop for a fraction of a second—you can then expose for 1/10 second at F/2 or F/3.5 and still secure an ideal action picture.

While this is not possible when photographing players in a game such as baseball or football, while they are actually in full motion, you will find that dancers, acrobats, divers, and many other types of athletes do almost invariably incur such complete lulls at some time or other in their studiedly co-ordinated performances. After watching a few such routines carefully, you will be able to judge with considerable exactness when to make your exposure with reasonable certainty of stopping motion.

For many outdoor action shots, however, and especially when you are shooting in color, you will find the supplementary flash very valuable because by its use you will avoid the harsh blacks and whites (or, in color, incorrect rendition) common to many such pictures and will be able to secure detail in faces and clothing which otherwise would be lacking.

For really fast-moving sports events (baseball, football, basketball, horse and dog racing, and the like) you will find the Exakta's 1/1,000 second speed will just about suffice. It will stop most action though there may be times when you will have to resort to the

OUTDOORS

1/5,000 second or faster speed of a flashtube. Only the fast lenses such as F/2 or better will give really good results with the 1/1,000 shutter speed, whether you are working outdoors with ample light or are working with flashbulbs or a flashtube. It is well to know that the 7″ F/2.5 Aero-Ektar has been successfully adapted for use with the Exakta because for sports shots this fast lens, finely corrected for color and with its exceptionally long focal length enables you to sit in the stands or bleachers at a sports event and still secure photographic images of adequate size. After all, only press photographers are ordinarily allowed on the playing field. This F/2.5 will permit you to use the 1/1,000 speed.

Stability with Telephoto Lenses. Finally let us remind you that when working with any lens of long focal length, a tripod or other solid rest (the low, flat-topped concrete wall which surrounds most baseball fields will serve admirably if you are fortunate enough to secure a front row seat) is an absolute necessity. The longer the lens, the more even the faintest vibration will be apparent in the negative, making satisfactory enlargement impossible. Keeping that in mind and using your Exakta equipped with suitable lenses, you can take sports pictures of which you will be proud, no matter what the light may be and whether you can shoot close up or have to do so from a distance.

MAKING THE MOST OF COLOR INFORMATION

Since more than 75 per cent of all amateur photography is shot on color film, the color wheel and color contrast charts for low, high, and simultaneous results can be used to good advantage if applied properly.

Let us presume that you are going to take pictures of a child's birthday party. The children will probably be dressed in their finest and most colorful clothes. This in itself gives color to the occasion, but you can add to the picture effects immeasurably by taking the surroundings into consideration. Note the color of the walls in the party room, the draperies, the upholstery, and other furnishings. Then consult the color charts in this book and select the ideal colors that will bring out the maximum color interest. It is simple to do and can be done so quickly that the selection process seems almost mechanical. But if you want to have color patterns that are effective, it *must* be done.

As another example of the importance of consulting your color charts, let us say that you plan to use your camera while taking a motor trip into the country. If the color of the countryside is known, then you can dress in an outfit that will produce the most contrast. If the countryside is dull and brown, as it may be in winter, you would not choose to wear rust-brown because it would merge with the background so that the effect would be muddy, without brilliance or contrast. A rapid scanning of the chart would enable you to choose the right colors.

A little forethought will save you many disappointments in your photographic results by assuring the presence of harmonious patterns. Use all the reference charts in this book. Each and every one has been included for a particular purpose and because it can be helpful to you. The objective is to supply information that is needed in a hurry, and if you familiarize yourself with the contents of the book, then you *will* be able to use them in a hurry.

CHAPTER 20 / CHILDREN AND PETS

Before those of our readers who are parents consider taking us to task, let us assure them that we imply no disrespect to their youngsters or themselves when we group children and pets together for the purposes of this chapter. Our reason is solely the very practical one that such subjects present similar technical problems in that they are extremely active, very sensitive to the glare of light and the heat of our lamps, and, in addition, must be restricted by one means or another to a definite area while being photographed. An ample indication of the problems encountered when photographing youngsters and household pets lies in the number of books which have been written on the subject, not to mention—so far as children are concerned—the innumerable demonstrations of this type of photography at conventions of professional photographers. The reader, however, has one definite advantage. He will almost certainly be working with members of his own household, or his and their friends, and not with total strangers. He should therefore have a certain initial command of the situation which the professional necessarily lacks.

The amateur who attempts to photograph a small child will do well, at least until he is fully conversant with the handling of his lights and the operation of his camera, to confine the youngster to a play-pen, high chair, crib, or bed. Even the fairly active child can be kept reasonably still with a doll or toy, and when a girl has reached the age where she can serve "tea" to her doll family, or a boy can busy himself with train and tracks on the floor, much of the task of planning a composition and keeping the small subject within reasonable range of the desired location is solved.

Control Movement. As for pets, usually fairly controllable when in the house with which they are familiar and faced with their masters, some reasonable degree of rather limited movement can be assured by placing the animal on a suitable table or bench. Very large pets—certain breeds of dogs, for example—are inclined to be less active and are best attempted when they have comfortably placed themselves in some accustomed location, as beside their master's chair, in front of the fireplace, or the like.

The bugaboos of glare and heat can be reduced to a minimum through the use of the bounce light technique mentioned in Chapter 18. To give you a point of departure for your first attempt, we recommend the use of four lights with respective ratios of 1–4,

FACTS ABOUT COLOR

Our studies of color can be standardized by differentiating each color in three ways:

Hue. This is the distinguishing name of a color, such as red, yellow, or green.

Value. This means the lightness or darkness of a color as compared with a white to black scale; for example: light green, medium green, dark green.

Chroma. This indicates the brilliance or purity of a color after it is toned down with gray; for example, orange to brown.

Selection of Color for Special Effects

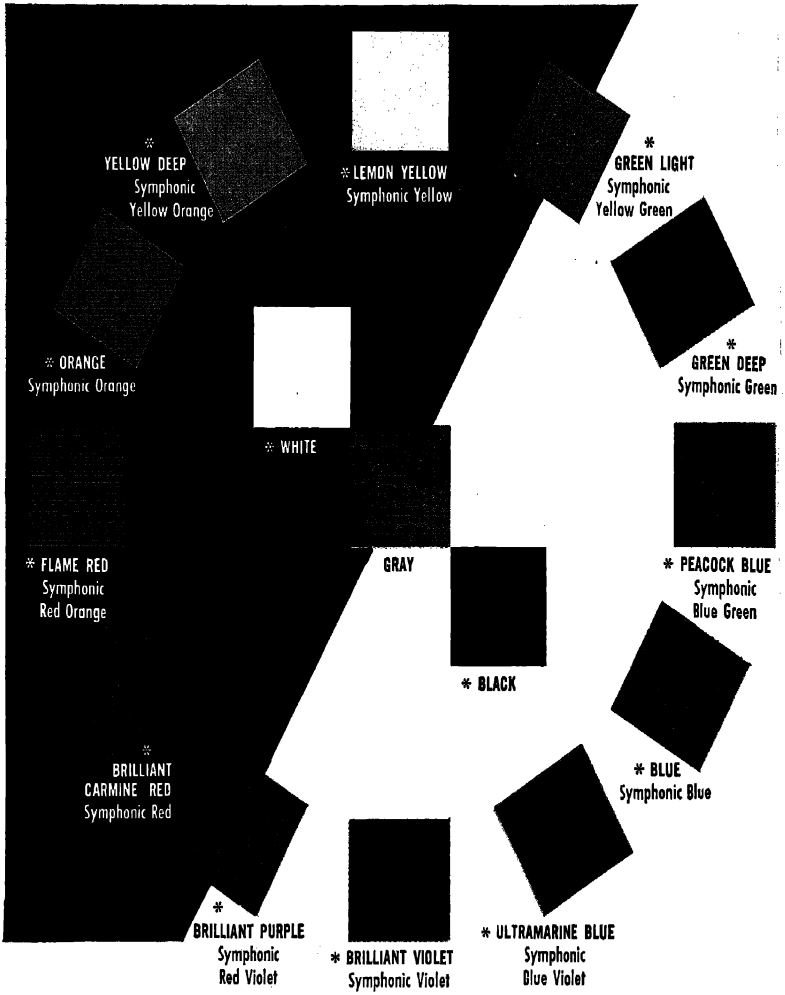
Harmonious colors adjoin one another on the hue circuit (color wheel); light green will harmonize with lemon yellow or deep green.

Contrasting colors are directly opposite each other on the color wheel; for example, lemon yellow contrasts with brilliant purple, or flame red with peacock blue.

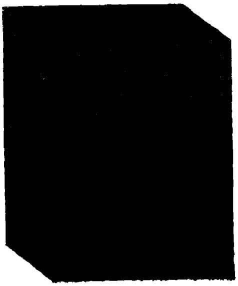
Triadic color combinations can be made by starting a single color and then drawing a triangle with two equal sides. The colors that occur at the three points of the triangle can be used together. Lemon yellow, flame red, and peacock blue or brilliant purple, orange and deep green are a few of the possible triadic combinations.

Simultaneous contrasting color combinations enhance one another beyond the usual degree of contrast when the proportions of their sizes and designs are varied. By covering the black square in the center of the wheel, the gray square seems lighter; covering the white square makes the gray seem darker. Illustrations 7A, 7B, 8A and 8B demonstrate this clearly.

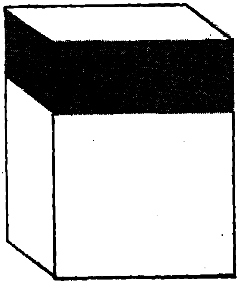
Greater contrast, as shown in illustrations 10, and 11, is best produced by selecting colors of strong (brilliant) chroma



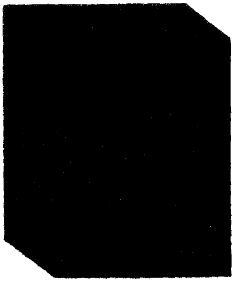
"Color Wheel courtesy of M. Grumbacher, Inc., manufacturer of Phototint and Artists' Colors."



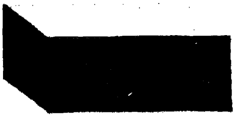
7A



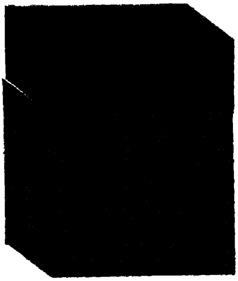
7B



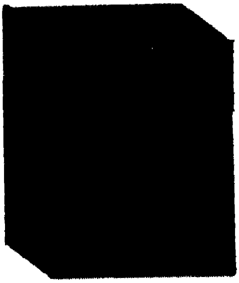
8A



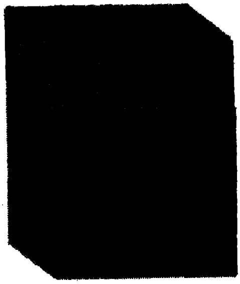
8 B



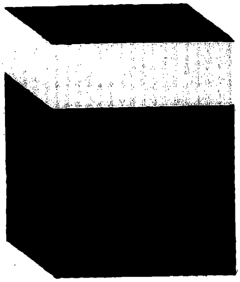
9



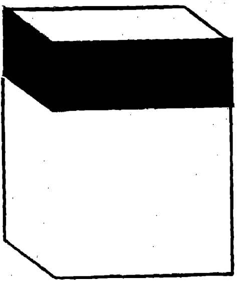
10



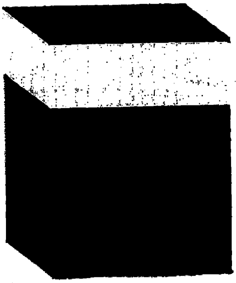
11



4



5



6

that have marked difference in value. Some of the possibilities are lemon yellow with black, ultramarine blue with white, and light green with brilliant violet.

Similarity of chroma and value causes a competitive disharmony that destroys the pleasant effect (see illustration 9). The chroma of one color should be weakened so that the other color will appear brighter and more dominant by comparison.

Visibility and legibility results when colors are chosen that have the greatest contrast in value. In illustrations 4, 5, and 6, it can be easily seen that a high, almost white, dilution contrasts best with a color of strong chroma (brilliance) which is without dilution (or vice versa).

Application of Color to Photography

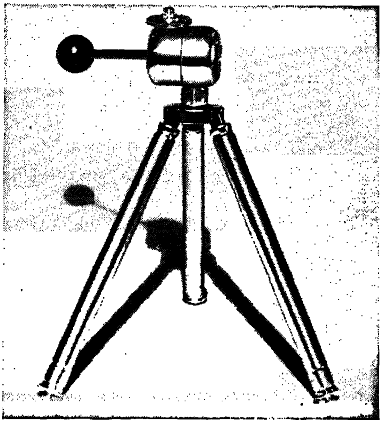
The three dimensions of color — hue, value, and chroma — must be applied efficiently when making a picture because color harmonies and contrasts are just as important in securing the final effect as are the technical and composition factors. For instance, a movie of children should be decorated with colors of light value, whereas a drama is usually costumed and decorated with colors of darker value. You will find it helpful to spend a day at a museum of art where you can study the many practical and different applications of the color theory.

*

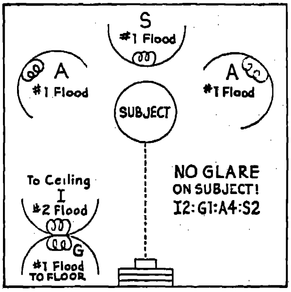
G–2, A–8, and S–1, as indicated in the accompanying diagram, with none of them beaming directly on the subject. You will have to watch the S light, however, and if it is not out of the direct angle of view of your lens, you will have to protect the lens by using a lens hood or you will have a bright glare or "hot spot" at that point in your picture. Using lamps of the strength shown in the diagram, and assuming that you are working in a room of average height with a white or reasonably light ceiling, your Exakta being loaded with a fairly fast film of A.S.A. 80 rating, your shutter speed should be 1/10 to 1/25 second at F/3.5 or 1/50 at F/2.

SCOTTIES

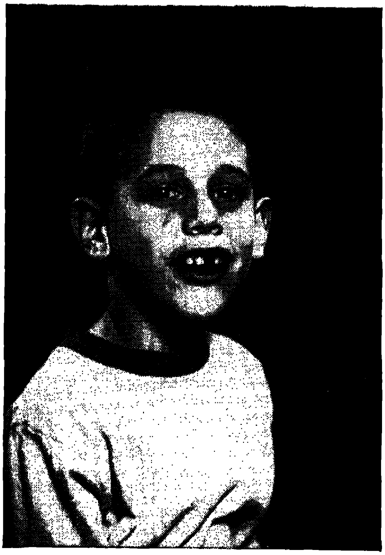
For children and pets, the faster speed will be better, but even at 1/25 we advise using a tripod to avoid moving the camera. With heat and glare eliminated, your subject will not be as nervous as if you were shooting with direct lights, and the possibility of movement



PRESTON MIDGET PAN HEAD FOR FOLLOWING YOUR SUBJECT QUICKLY IN MOST DIRECTIONS.



ANOTHER SUGGESTED LIGHTING DIAGRAM



AN 85 OR 90MM LENS SHOULD BE USED FOR PORTRAITURE. PICTURES TAKEN NOW, SOON BECOME IRREPLACEABLE MEMORIES.

will therefore be reduced. Finally, if you watch for the peak of action and are ready to take advantage of it, you should be able to shoot at a moment when you catch the right expression or pose.

The preferred lens for such active subjects is one of 85mm or 90mm focal length which will assure a large head at a 6′ camera-to-subject distance. Using either the ground-glass or the ortho prism, you can follow a young child as he moves about and yet, because you do not have to work too closely, you do not distract the child from what he may be doing and thus maintain the natural effect you want. This factor is important because, using a 50mm lens, you would have to be within 36″ from your subject to secure the same size image. Put yourself in the child's position and judge if you could act normally with bright lights glaring on you and some grown-up gyrating around and pointing some strange object at you, barely out of reaching distance. The longer focal length lens gives both photographer and subject greater leeway and results in far more satisfactory pictures.

CHAPTER 21 / PORTRAITURE

Portraiture is so varied in its scope that we can do little more here than offer a few general suggestions, beyond which the amateur who wishes to take it up seriously should buy and study one or more of the numerous good books available. Many camera clubs, especially those in the larger cities, offer instruction in portraiture to their members, and in any event we heartily urge the Exakta owner to join such an organization. In connection with this chapter we show a typical amateur portrait with a diagram of its lighting, but beyond that the reader will have to experiment until he has mastered the basic difference between a genuine portrait and an ordinary amateur snapshot: the securing of an accurate likeness and expression *and,* through proper lighting, a true characterization or interpretation of the sitter. A likeness alone is no portrait—even a passport picture will resemble its subject—and must be supplemented by proper posing and expression. Characterization and interpretation require the proper placement of the lights so that, by the proper interplay of light and shade on the features, we accentuate this or subordinate that until the final photograph presents the subject as his relatives and friends know and understand him. The painter does this with his brush, the sculptor with his chisel, both working

OUTDOOR PORTRAIT

BOUNCE LIGHT PORTRAIT. 90mm: 1.8:1/50

always to present the inner being rather than merely the exterior outline. The photographer does the same except that he paints or chisels with his light.

The Exakta lends itself admirably either to interpretative, carefully studied and planned individual pictures, or to rapid sequences from which one exposure at least may catch the desired spark. Its thirty-six exposures permit instant and certain readiness to take advantage of pose and expression. The rapid advance of the film (winding) to the next frame eliminates the delay in changing film holders required with other types of camera. The combined shutter-wind obviates the need for constant re-setting. And, with 35mm film, the cost per frame is so low that a few wasted exposures are of no serious moment. This is important because, especially at the beginning, many pictures will have to be taken before even a few may be considered as successful portraits. As you experiment you will soon learn how a slight alteration in pose or the movement of one light as little as 1° in angle or 1″ in placement will suddenly uncover an entirely different impression of your subject.

When working with very small negatives, as is the case with the Exakta and other miniature cameras, to secure a lens with a focal length which will afford the modeling so desirable for portraiture, the best rule is to double the length of the diagonal of the film frame. Thus the Exakta size picture indicates, for portraiture, an 85mm or 90mm lens, approximately a length of 3⅝″. While this may not seem much in the way of size, you can get a better appreciation of what it means if you consider that were a similar ratio used for an 8x10 camera, the indicated focal length would be 25″. Actually the professional does not use that ratio with his larger size cameras, but it is proper for the size film you are using. His portrait lens will probably be 12″ or 14″ focal length for an 8x10, but you can see how much simpler portaiture will be for you with your Exakta and we can assure you that it will be very different in its purpose and final effect.

Sharp or Soft Negatives. There are two types of lenses available in the 90mm size which we advise for portrait work. One cuts a very sharp image; the other produces a "soft" image which subdues details and has a happy tendency to minimize blemishes, wrinkles and the like. This is a big advantage to the 35mm user because the film size is too small for satisfactory retouching. There is this, however, to remember: the sharp image produced with the one lens may be later softened in several ways when desired; a soft image which the other lens gives can *never* be made sharp. Therefore, at the beginning at least, a lens of the sharp type is your best purchase. Softening (or "diffusing") of the image may be accomplished while enlarging, through the use of fine silk, netting, or screens made for the purpose, or other materials; in fact, as you become experienced you may even want to try using various diffusing materials over the Exakta lens when you make the original shot. The point is that with the sharp lens you diffuse when you wish and still make all your other pictures as sharp as you please. Then, when you have reached a more advanced stage, you can choose from the great variety of lenses available for the Exakta those which will best suit the purpose you have in mind.

When working with older people you can of course aim your floods and spots directly at them, but even though many of them will be accustomed to this as a result of formal posing in professional studios, there will still be a tenseness and feeling of strain. You will find it far better to use the bounce technique (reflected light) already mentioned, and this will enable you better to depict your subjects as they live and act, whether in the home, at the office, or engaged in some form of recreation. With a few floods in suitable reflectors you can, with the bounce technique, create a glareless, heatless, even lighting which will permit you to shoot, with the Exakta, many different rapid exposures in a complete sequence with no break for re-loading or re-setting. For lighting arrangements we propose the following I–G–A–S ratios: men—4–I, 1–G, 8–A, 3–S; brunette women—3–I, 1–G, 6–A, 3–S; blonde women—2–I, 1–G, 4–A, 2–S. Let us emphasize that these are not fixed ratios but merely points of departure, because no two subjects are alike. Pose your sitter, place your lights according to the appropriate ratio, study the resulting lighting on face and figure, and then proceed to move your lights until you secure just the effect you desire.

Different People—Different Problems. Some practical suggestions will be helpful here with respect to certain types of subjects. Confronted with stout, full-faced sitters, you must, if you expect to please them, attempt to make them look thinner than they are, and especially is this true of the face when you are photographing the head and shoulders only. Retouching, such as is resorted to by the professional, is out of the question on your tiny Exakta negative, so you must do what you can with your lights—and you can do a great deal. The human eye, in observing any picture, is always drawn toward light areas and tends to ignore dark areas or shadows. This phenomenon enables you to solve the problems of a full face by lighting the middle third of the face and keeping both cheeks in slight shadow, with the camera at least 6′ away in order to avoid a bulging distortion. The effect will actually be to make a full face look thinner.

When making a three-quarter length of a stout person, avoid having the subject sit in a normal chair because there will be an immediate tendency to slump and thus accentuate the normal heaviness of the figure. Select instead a rather high bench or chair which will require the subject to stretch a bit to get the feet on the floor; insist that the subject sit erect, sideways to the camera at about a three-quarter angle, with the head held a bit high; then shoot with the camera at a low angle and the subject's face turned toward the camera. Again your lighting should emphasize the middle third of the face, the light falling off as rapidly as possible at the sides and receding also at the sides of the figure.

If your sitter is thin, your intention must be to light the face to give it more mass and so, reversing the method just explained, you light the cheeks so that they are in a 2 to 1 ratio over the middle third of the face, whereupon the thin-countenanced individual promptly gains in facial breadth. When photographing a thin person, bring the camera closer to the subject and show the figure as full-front as possible. If the hands are long and bony, conceal or efface them to some extent by having the subject hold a book or other prop. One point with respect to hands: never photograph the backs of the hands straight on, or you will have a large light area in your picture which will detract from the face, which must at all times be your center of interest. Photographs hands from the side always and, if your sitter after two or three attempts does not naturally pose them satisfactorily, have no hesitation in arranging them yourself. Proper placement of the hands is an important feature in securing genuinely characteristic portraits, but hands can also—if over-emphasized in lighting or inelegantly posed—completely ruin a picture.

Bald Heads. Careful control of light and shadow is a big help when photographing bald headed men. So long as too much light does not reach the top of the head, you can flatter the sitter by minimizing his baldness while still showing him as he really is. The professional handles such a situation with what is called a "head screen," a rectangle of black fabric on a goose-neck stand. When he is dealing with other sitters, he makes use of this same screen to keep from over-lighting and over-emphasizing the ears. You can attain the same results by holding a flat piece of cardboard so that it shades the top of the head, or any other feature you want to minimize, from the light. If you have no stand or fixture to hold this in place, you yourself can hold it before the particular light that is causing the trouble if you use a long cable release that will enable you to get far enough from the camera. Your purpose will be to reduce the light which is striking the top of the head, the ear, or whatever you want to tone down, so that its strength becomes only one-fourth that of your main *I*llumination light.

Eyeglasses. So many people wear glasses nowadays that a word must be added concerning this problem. One very simple solution is to have the subject hold the glasses in his hands; another is to keep on hand a pair of spectacle frames without lenses, because, of course, it is the lenses which cause all the trouble by reflecting light and thus causing unpleasant flares or blank spots in the picture. But both of these do little more than dodge the issue, because no person who customarily wears glasses looks natural without them on. Also, unless the lenses are his own, the lack of them will show in the expression of the pupils and a certain tenseness of the muscles surrounding the eyes. It is far better to attack the problem frankly, and you can do so in two ways. If you are using direct lighting on the subject, having first secured the general effect you want on the features, you must scrutinize the lenses and their frames carefully from the camera. If there are any bright reflections on either you can quickly tell which light is causing the trouble and you must then adjust it either in angle or position until the reflection disappears. Then you must check again very carefully because very probably you will have to move other lights slightly as well. Or you can switch to the bounce technique whereby, with no one concentrated source of light striking your subject, there will be no spot reflections and both lenses and frames will photograph cleanly and clearly. Having experimented a little, you will find that glasses are by no means the serious difficulty that so many photographers consider them.

Sometimes you will come across a subject with a really beautiful or unusually striking profile and you may want to try what the professional calls a "line lighting" on the profile itself. Again you can do so with an adaptation of the I–G–A–S Formula. Place your subject in profile to the camera and set up your lighting normally. Then, from the side to which your subject is looking, throw a narrow beam of light from a spot directly on the profile, this light being at a ratio of 4 to 1 with respect to your *I*llumination light. You will find that you are genuinely "painting with light," because this one beam will outline the profile as definitely as if it were done with a single stroke of a paint brush.

Again we must stress the importance of an understanding of the I–G–A–S Formula, because with it we can logically solve any lighting problem that may arise. You will find that you are truly painting with light and that your appreciation of the action of light on a photographic emulsion enables you to know in advance the strength and character of the image you will produce on the film. The Formula holds true no matter what lights you may have available, and its proper use and proper application place you at an inestimable advantage over others who may have unlimited light sources at their disposal but only a limited knowledge of what to do with them, and why. Knowing your Formula and faced with a subject whom you want to portray, you need only make a rapid analysis of what type of lighting is required and then adjust your lights to secure the effect you desire within the limited recording range of the emulsion.

Start Right. Assuming then that you do understand the I–G–A–S Formula, we can close this chapter with one very worthwhile tip, because you will know in advance of your sitting the approximate placement of your lights. Turn them all on before your subject enters the room. Thus while you are moving the lights into their final positions, his eyes will have an opportunity to accommodate themselves to the more-than-normal illumination that portrait photography requires. (His opinion of your knowledge and ability will also, incidentally, be markedly enhanced.) In that way you avoid the shock to the subject's eyes and nerves that comes when powerful lamps are suddenly turned on; your subject will be more relaxed and natural when the time comes to trip the shutter and your portraits, reflecting this feeling of comfort rather than one of strain and irritation, will more surely approach being genuine characterizations.

CHAPTER 22 / CLOSE-UPS, COPYING, MICROFILMING, AND PHOTOMACROGRAPHY

The title of this chapter may seem somewhat in the nature of a catch-all, but it takes up four important uses for your Exakta that are basically interrelated and therefore logically grouped. Let us first define each:

Close-ups are made when we wish a considerably larger image of a subject than is possible at normal lens focusing distances, and under this classification we include those pictures where the subject is between 3½ feet (the nearest point at which most lenses focus) and 9 inches (the nearest distance generally recommended for the use of a Plus 3 Portrait Lens.) These are purely arbitrary figures.

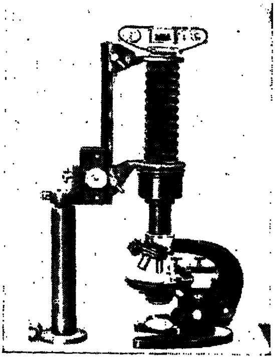
Copying can be defined as photography accomplished with the subject at distances between 9 inches and 4 inches from the camera. The 4-inch distance is selected because the image will be reproduced at a 1:1 ratio. This means that if the subject is one inch in width or length, the film image will be exactly the same size on the negative.

Microfilming is the copying at a very great reduction in size of anything flat, such as a document, printed page, photograph, or whatever may be inexpensively and clearly recorded on 35mm film. Such copies are later projected by means of a "reader" or other device back to their original size for reading or reference.

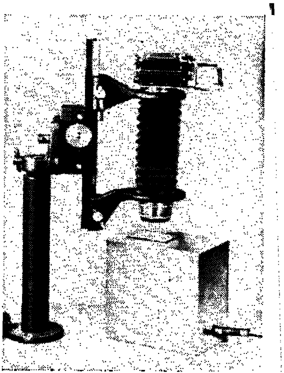
Photomacrography, on the other hand, is the production on the 35mm negative of film images larger than the original subject through the use of extension tubes or bellows focusing devices but without the use of a microscope. When a microscope is used, such work is called photomicrography and will be covered in another chapter.

Generally speaking, most lenses only focus to approximately 3½ feet. The 2-inch Exakta lenses focus as close as 24 inches, depending upon the model. With the Exakta, there is no parallax problem and what you see is what you get.

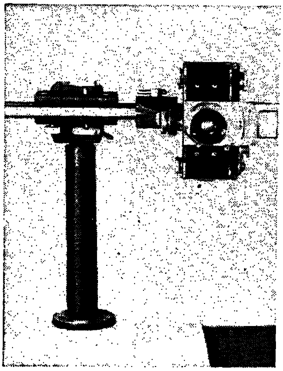
Portrait Close-ups. In speaking of close-ups, we mention a Plus 3 Portrait (a supplementary positive) lens. Actually there are many such lenses, the most commonly used being a No. 2 and a Plus 3 (No. 3), which are retained in a filter holder in front of the standard lens on your Exakta. At such close distances, subject and camera must be firmly positioned because the slightest movement of either can throw your image out of focus. One way to assure rigidity is to place the camera on the tripod, the lens facing down toward a base-



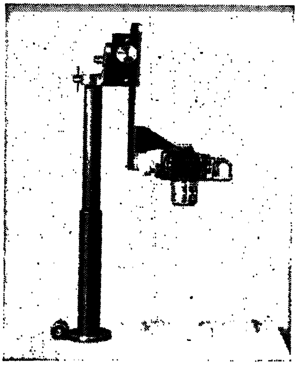
THE VERSAL FOR PHOTO-MICROSCOPY.



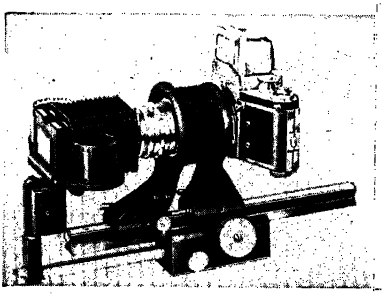
THE VERSAL FOR COPYING.



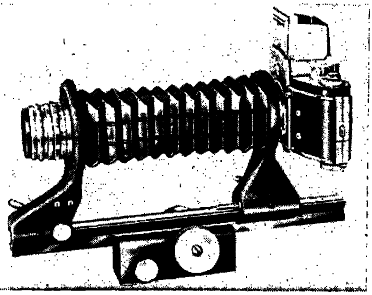
THE VERSAL FOR STEREO.



THE VERSAL FOR MICROFILMING.



THE VERSAL FOR DUPLICATING OR PRINTING TRANSPARENCIES.



THE VERSAL FOR CLOSE-UP PHOTOGRAPHY.

board at a measured distance from the lens. The Exakta Copying Stand has been designed for this purpose. It prevents the camera from being moved as you advance the film; otherwise there is a tendency for the camera to turn on the tripod. A bubble-type level is very helpful in assuring perfect reproduction of vertical and horizontal lines in a subject. When a close-up of a person is being taken, keep the plane of the face on the side rather than from front to back to avoid distortions.

No increase of exposure is necessary when positive supplementary lenses are used over the regular lens.

Focal Frame Close-ups. In a close-up you must be certain both of focus and the outline of the field. The automatic pre-set diaphragms assure both, yet it may be more advantageous to use a focal frame if the subject is in an out-of-the-way spot—for example, a flower in a corner of a garden. A focal frame is a device made of metal, heavy wire, or wood which both outlines the field of view and holds the camera at the predetermined distance from the subject. Should quick-change settings be needed, portrait lenses or the Versal are suggested.

With the focal frame, you need only center the subject within the area bounded by the outline, bring the edges to the front of the subject, and make the exposure. With a subject that has considerable depth, bring the focal frame to approximately one-third the total depth.

Supplementary (portrait) lenses do not require the removal of the standard lens from the camera. They are satisfactory and unquestionably the most suitable if you do not wish to go in for elaborate set-ups. However, if you will be copying at all distances, copying all shapes, matters, and forms, then the versatile Versal is exactly what you need. The Versal is *the instrument* for technical and scientific fields.

To get back to supplementary portrait lenses, you are probably wondering whether, since they are so good for close-up distances, they cannot be used for still shorter subjects. The answer is that the portrait lenses have weak (up to Plus 3) and shallow curves, but the stronger and steeper curves required for the design of Plus 13, Plus 20, etc., lenses would introduce aberrations and distortions which interfere with the basic effects of the standard camera lens so that the image quality would suffer.

Note again that no increase of exposure is needed with portrait lenses.

Extension Tubes

Extension tubes are used to increase the separation of the lens from the film plane so that shorter distances will be in focus. An extension tube is rigid and must be lengthened in sections or shortened as different points of focus are needed. Extension tubes do require an increase of exposure because the lens is curved away from the film plane. The increase of exposure, called the exposure factor, is multiplied with the regular exposure. As an example, if the regular exposure called for a one-second shutter speed, then an extension tube with a factor of 2 would require a one-second 2 X, or a two-second exposure. If an extension tube with a 4 X factor is used, then the exposure would be one second x 4, or a 4-second exposure.

The Exakta lens is attached to the camera with a bayonet mount. Whenever the lens is separated for extension tubes, a set of male and female mounts (the male to attach to the camera and the female mount to accept the Exakta lens) must be used. The male and female mounts are screwed together and can be unscrewed so that extension tubes of different lengths can be placed between them.

Since the mounts themselves have a thickness of approximately 15mm, there would be an "empty" spot which normally could not be focused at. The Ihagee Company makes what is called a two-in-one adaptor, which is both a male and a female ring in one. The extension is only 5mm and it covers the previously empty spot so that it is possible to have a continuous range of focusing from infinity down to the use of a microscope.

In using extension tubes remember these points:

1. Have a sturdy supporting column for your Exakta because exposures are usually slow.
2. Use a bubble level to assure your camera and film plane are parallel.
3. Label, paint, or engrave the exposure factor onto the barrel of your extension tube. Unless the latter is prominently before you, it may be overlooked and your picture will be underexposed.
4. Use a cable release to avoid any vibration. If a cable release cannot be used, then set the self-timer.
5. Light your subject for uniform illumination.

The Ihagee Versal for Continuous Focusing. Knowing how to use the Versal is to know photography, because you will know everything about exposure, subject management, focusing, illumination—in other words, all photography. The Versal functions as a continuous variable-length extension tube by eliminating the need for frequent time-consuming changes of two sections as various subject sizes are photographed.

Exposure factors are engraved on the bed of the Versal. The Versal may be used for Stereo, for macrophotography, and for microphotography without requiring any new apparatus.

Microfilming has assumed great importance in the field of record keeping because one can copy on a single 35mm frame anything from a business letter (or smaller) to a full-size newspaper page. This saves space, is economical, and can be quickly indexed for reference. Professional people such as doctors find their Exaktas valuable in preserving important records or articles from their magazines. They can be easily filed and read later with a projector.

The Exakta copying unit is compact, lights the copying material uniformly, and will make copying a routine procedure. When the Exakta is operated as a microfilming unit, consult your exposure data and repeat the successful set-up that was used. Microfilming should be a routine procedure.

Copying Film. A fine grain positive film usually is used. No special fine grain developing is required. However, if you plan to make slides of the copy material for later projection, then a fine grain developer might be advisable. Actually, from such an original as a newspaper page, the negative, with its white lettering on a black field, is far easier to read when projected than if you positive print the emulsion to reproduce the original black letters on a white field. It saves one step and is usually easier to read. If white letters are to be read on a black field, then place a light yellow or green filter over the projection lens. The type of material will then appear as a light green or yellow on a black field—colors which are more easily and comfortably viewed by the eye over a length of time than pure white on black, which will, if studied constantly, cause eye strain. In projection, too, large expanses of white tend to produce a glare.

Copy Lighting. For microfilming, copying, and close-ups generally, uniform lighting is desirable. You might say that the I–G ratio should be 1:1, but in practice there will be no G light because you will light with even strength from two opposite sides, or preferably from all four, in order to entirely eliminate shadows. Be careful, too, not to block off any portion of the illumination with your own body or you will immediately throw the lighting off balance and cause a shadow that will be seen on the final print. As the depth of field diminishes the closer the lens approaches the subject, as narrow a stop as possible is desirable—f/11 or f/8 at a minimum.

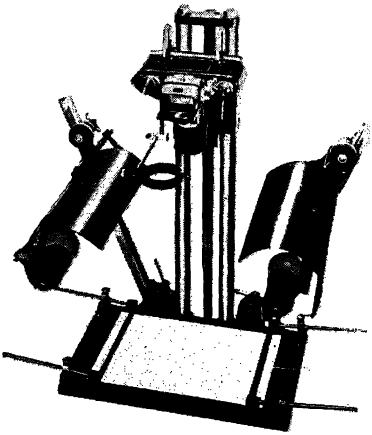
Repeating again: positive lenses do not require an increase of exposure, but extension tubes or the Versal requires additional exposure factors.

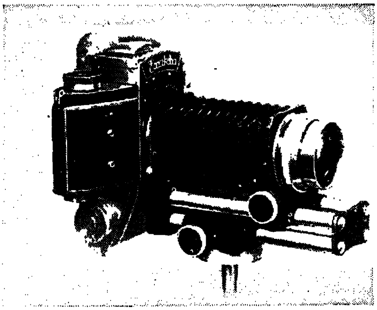
Polarizing Lights for Copying. An original with a highly glossy surface may cause a glare, blanking areas on the negative. This problem can be reduced if a polarization filter is placed over the lens; if the glare is serious, the lights should also be polarized. In copying oil paintings which have considerable gloss, or colored works which have been varnished or lacquered, the lamps should be polarized both to prevent glare and to increase the saturation of your colors. The average filter factor for a polarizing screen over the lens is between 2.5X and 4X, while the lamps are usually 4X, so that a picture copied when both the lights and the lens are polarized will have an exposure factor of 16X. Now, if considerable extension is involved, these figures may even go up to 128X.

Reading Microfilm. A microfilm reader permitting projection of your microfilmed documents back to their original size on the baseboard, or on a screen or wall when larger sizes are desired, has been commercially available for some time. Of course, any standard tube X2 projector with an accessory roll film unit may be used as a microfilm reader. Finally, store all your 35mm negatives in a special microfilm box. Each box accommodates nearly 7000 frames, thus enabling you to file in small space the equivalent of 7000 documents or printed pages, pictures, snaps, or whatever you wish to keep on record for ready reference.

To review the process of microfilming, macrofilming, and close-ups, remember this procedure:

1. Select the field size that will cover your object and select either the portrait lens or the extension tubes that must be added for this size.
2. Set the camera and its accessories on a sturdy tripod.
3. Illuminate your object uniformly and calculate the exposure.
4. Add any extension tube, polarizing filter, or regular black and white filter factor.
5. Use a cable release or the built-in-self-timer to make the exposure.





THE COPY MAT SET-UP FOR PRE-SET, SIMPLE COPYING OR MICROFILMING.

Extension tubes put in	total distance cm.	image distance cm.	object distance cm.	exposure factor	scale of pictures
without bayonet rings and tubes	∞	5	∞ ⊕ 64,5	1,0	variable
both bayonet rings (140 and 141)	41	6	35,0 ⊕ 25,0	1,4	1 : 5,8
both bayonet rings and Tube 142 (5 mm.)	31,5	6,5	25,0 ⊕ 20,0	1,6	1 : 3,9
Tube 143 (15 mm.)	24,0	7,5	16,5 ⊕ 15,0	2,2	1 : 2,2
Tubes 142 + 143 (20 mm.)	23,0	8,0	15,0 ⊕ 13,5	2,5	1 : 1,9
Tube 144 (30 mm.)............	21,5	9,0	12,5 ⊕ 11,5	3,2	1 : 1,4
Tubes 142 + 144 (35 mm.)	21,0	9,5	11,5 ⊕ 11,0	3,5	1 : 1,2
Tubes 143 + 144 (45 mm.)	21,0	10,5	10,5 ⊕ 10,0	4,3	1 : 1
Tubes 142 + 143 + 144 (50 mm.)	21,0	11,0	10,0 ⊕ 9,5	4,8	1 : 0,9

⊕ All the items in the table refer to the shortest interval of the helical screw (i. e. focussing mark at ∞!). It is for the object distance only that, second place, the distance has been mentioned which exists between the lens and the object when focussing the lens for close-up exposures (i. e. for Tessar 3,5 focussing mark at 0,70 m.)

The above table shows which exposure distances and scales of pictures are possible when using the bayonet rings and the extension tubes, provided the KINE-EXAKTA is equipped with a Tessar 1 : 3,5/5 cm. The following explanations refer to the headings of the above table:

1. Total distance = distance between the object and the film plane in the KINE-EXAKTA (in cm.);
2. Image distance = distance between lens (about shutter plane) and film plane (in cm.);
3. Object distance = distance between object and lens (about shutter plane — measured in cm.);
4. Prolongation of exposure time:
   Increase of camera extension requires longer exposure time. (Exposure time 1,0 = correct time oft exposure for ∞ focus without bayonet rings and tubes);
5. Scale of pictures 1 : 5,8 means e. g. 5,8 cm. of the object appear as 1 cm. on the negative.

CHAPTER 23 / PHOTOMICROGRAPHY—MAGNIFYING IMAGES 25X AND UP

Exakta photomicrography is ideal because the ground glass permits you to see the subject at all times until the very last instant before the exposure is made. Parallax, as you have been told again and again, is no problem.

Photomicrography, as you know, is the photographic recording of magnified images of minute objects that can only be seen with a microscope. Let us organize your photomicrography with the materials and procedures that will make successful pictures.

Light Source. A P-10 tungsten ribbon filament, 18-ampere, 6-volt lamp (some microscopes already have built-in illuminating lamps); an RSP-2 floodlamp or an electronic flashlamp can be used.

Film. Any black and white film can be used. However, fine grain is preferred to resolve the minute detail that usually is wanted. All color film can be used, but you must match and mate the film to the color temperature of the light source. Electronic flash should be used with daylight Kodachrome while the RSP-2 floodlamp should be used with Kodachrome, Type A.

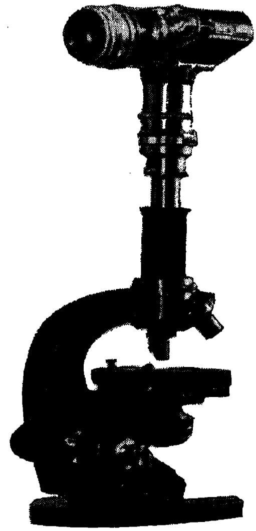
Microscope Attachment. The Exakta Company supplies either a single-unit separable microscope adaptor or a single-unit removable adaptor. The separable unit is preferred by many because it allows a rapid technique wherein you can use the microscope visually and then photographically without loss of time. Either unit functions efficiently, so it may be a matter of personal taste in selecting a type.

Focusing Screen. The Exakta is unique in that there are five different kinds of ground glass focusing screens specifically made for scientific and microscopic photography.

Focusing Magnifier. As sharpness of focus is a basic requirement for a good photomicrograph, Ihagee designed a special magnifying unit which utilizes your regular lens for magnification. It is called the Magner Coupling. The Magner with the special focusing screens brings us one step nearer to better focus.

The Focusing Tellup. The finest possible focus is secured by placing the Tellup on top of the Magner for critical sharpness. The Tellup provides an additional 15X magnification so that it is virtually impossible to produce an unsharp picture.

MAGNEAR, ON CAMERA, HELPS SHARP FOCUSING.

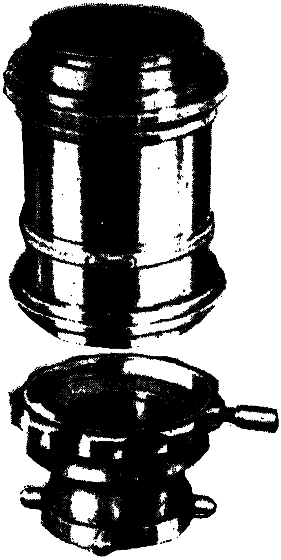


Assembling the Set-up:

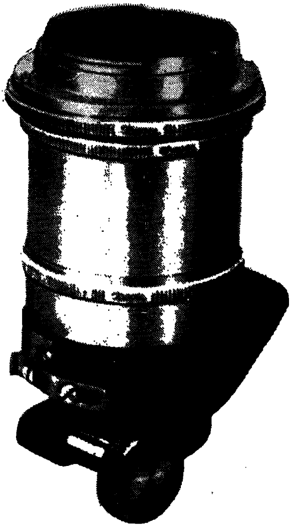
1. Remove the camera lens from the camera and place it in a safe place or use it on top of the Magnear.
2. Remove the microscope eye piece.
3. Fit the microscope adaptor over the microscope barrel and tighten it.
4. Replace the eye piece where it normally rests.
5. Focus the microscope.
6. Fit the camera body over the bayonet prongs of the male adaptor. Rotate the camera and fix it in place.
7. Bring the microscope adaptor together and view the image on the ground glass, making any focusing correction.
8. Visual unit (1:1) as seen by the eye occurs when an object is at a 250mm (10-inch) distance. As a 250mm extension would require long exposures, we compromise with a 90mm extension so that the exposure is shorter and the final image is usually satisfactory both for taking and viewing.

Exposures. Exposures may be read with an exposure meter placed about 2 inches from the ocular. The meter must be read from this exact distance each time if your chart will be valid.

Electronic flash can be used by first focusing from an exact distance to the center of the reflecting mirror and then placing the bare lamp in front of the focusing light. The response of different speed lights varies so much that you must test your own unit for your own future reference.

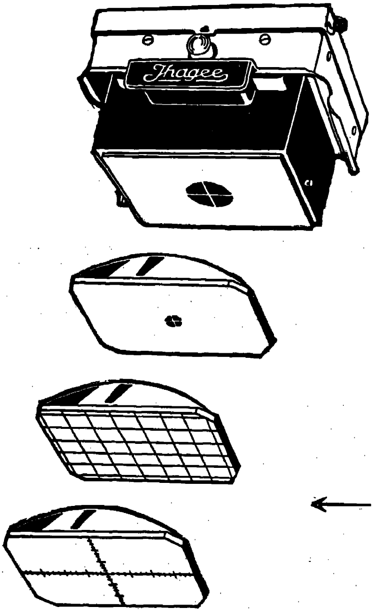


MICROSCOPE ADAPTER WHEN ONLY ONE PERSON IS TAKING PICTURES.



MICROSCOPE ADAPTER FOR TAKING PICTURES WITH MANY MICROSCOPES. THIS TYPE PERMITS INTERCHANGING MICROSCOPES EASILY AND QUICKLY.

MAGNEAR FITS INTO GROUND-GLASS SPARE AND THEN TAKES REGULAR LENS.



←SPECIAL GROUND GLASSES FOR PHOTOMICROGRAPHY ARE INTERCHANGEABLE WITH REGULAR GLASSES IN THE CAMERA'S FOCUSING HEAD.

Stereoscopic, or three-dimensional, photography is so far in advance of any presentation of an image on a flat plane—and we include even the finest single color transparency when seen by projection—that we like to think of it as the "champagne of photography." Granted, it offers greater complexities in taking the picture and in mounting the resulting slides, but the startling realism of stereo images warrants any amount of extra trouble and effort. With the Exakta, three different methods for the production of stereos are possible.

The first, appropriate only for still-life subjects, utilizes a single camera, which must be shifted approximately $\frac{1}{50}$ of the distance from the camera to the subject between the two successive exposures which correspond to the two images seen respectively by the right and left eyes. This shift cannot be accomplished by any free-hand method and requires the purchase or construction of a stereo shift bar. The manufacturers of the Rolleiflex and Leica cameras at one time made such bars and, while they do not do so now, it is occasionally possible to pick one up at second-hand. The Radex Company, a California firm, is now making an excellent device of this type.

Shift Method. It is not too difficult to make a shift bar yourself, and because the information is not too readily available, the detailed instructions follow: Obtain a strip of wood molding 1″x1″x9″; drill one of the 1″ sides at the exact center and force-fit into it a standard tripod bushing. Then, into one face of a wood block 2″x2″x2″, chisel across the center a channel 1″ wide and 1″ deep. The bottom of this channel must be smooth and level because this block is to slide back and forth over the top of the molding strip already mentioned. When the block is placed on the molding, the channel will of course be on the bottom. In one side of the channel, just above the bottom, drill and thread a hole clear through to the channel so that when a thumb-screw is inserted in the hole and turned fast, the block will be held tightly in place on the molding strip.

Where the thumb-screw touches the molding, groove horizontally a ½″ channel the full length of the molding. The set-screw tip will fit inside this channel. The block may thus be loosened on the molding but cannot slip off as long as the tip of the set-screw is within the channel. This is a necessary safety factor. Next, turn the block over so that the channel is on top and in the center of the channel drill clear through the block and thread for a ½″x20 screw. This screw will protrude through the top of the block. Now you can your Exakta to the block by turning this screw into the tripod socke of the camera.

You then have a finished shift bar which can be affixed to tripod and on which the Exakta will slide from side to side between exposures. You must still calibrate the bar so that you may move the camera the proper distance between exposures to maintain the 1/50 subject to camera distance. Move the camera to the left end of the bar. It may be advisable to fasten an upright set-screw at each end so that camera and block may not be inadvertently slid off. With the camera at the left end of the bar, tight against the set-screw, and the back of the camera toward you, draw a line on the shift bar exactly in line with the left edge of the camera block. Remove camera and block and lay the molding down. Using the line you have just drawn as the zero of a scale, mark off from it about 6″ in ¼″ sections, using India ink or some form or marking which will be permanent and will not smudge from the later movement of the block.

Directly below this scale place the following markings: at the ¼″ mark—1′; at the ½″ mark—2′; at the ¾″ mark—3′; at 1″ mark—4′; at 1.2″—5′; at 1½″—6′; at 1.7″—7′; at 1.8″—8′; at 2.2″—9′; at 2.4″—10′. This calibration may be continued as far as desired for longer camera to subject distances, always remembering that the separation must be 1/50 of each such distance.

With this scale available and easily seen on the shift bar, no charts are necessary. Fasten the shift bar to your tripod. Replace camera and block on the shift bar. Slide the block to the right end and fasten camera and block securely with the thumb-screw. Focus carefully, measure your distance from camera to subject and make your first exposure. Then move the camera block to where its edge is in line with the appropriate camera distance length on your scale. Again tighten the thumb-screw and make your second exposure. In this way you always take the right view first with the result that you always have as negatives the right view on the left side facing the lens and the left view on the right side facing the lens. When the negatives are reversed for printing, the right positive view will always be on the right side and the left view on the left side, simplifying your mounting and everything else. The exposures made, the resulting 35mm transparencies may be mounted in stereo mounts available from several sources.

You can show your finished positives in a Standard Stereo Realist viewer if you mask your ground-glass at each side with a bit of acetate tape just enough so that the image on the frame is reduced from the normal Exakta 24x36mm (1″x1½″) size to the Stereo Realist standard size of 24x24mm (1″x1″), and when working with this size you can use the camera either vertically or horizontally. On the other hand, if you plan to use the Verascope 40 viewer, which requires an image 24mm high by 30mm wide, you are limited to horizontal shots but need only mask the ground-glass enough to cut 3mm, or about ⅛″, from each side of the frame.

Double Camera Method. For a second method, two Exaktas are required, mounted vertically side by side on a straight horizontal bar but in such a manner that while one may be fixed permanently, the other can be slid away from it along the bar so that at all times the distance between the centers of the two lenses will be approximately 1/50 the distance from camera to subject. When the two cameras are set on the bar with their sides touching, the lenses will be just about right for subjects 10′ away. With the ground-glasses properly masked as already explained, the pictures can be mounted in Realist slides for use with the Realist viewer. With a little ingenuity any good gadgeteer can rig up a device for tripping both shutters simultaneously. The advantage here, obviously, is that action pictures can be taken, which is out of the question when using only one camera which must be shifted between the two exposures.

Stereo-Tach Method. Finally, and simplest of all, you can attach to your Extakta a four-mirror reflecting device (such as the Stereo-Tach) which will produce two different images—though necessarily they will be much smaller—on your standard 24x36mm frame. Each image will be 24mm high and 18mm wide and since they will be side by side on the one frame, with the principal points of the images only 18mm apart, such stereos cannot be viewed in the standard stereo viewers in which the viewing lenses are at least 65mm apart. Instead, for these you use a viewer which is essentially the taking device reversed: while the lenses placed against your eyes are 65mm apart, a four-mirror arrangement permits each eye to see one image at the 18mm separation. So far as your eyes are concerned, each sees the image at normal eye separation and proper fusion of the images takes place so that you will see the effect of depth and three-dimensionality which is the beautiful feature of stereo.

Whichever method you decide to follow, we urge that you use color film because it is color that adds the breath of life to stereo. You will find, when you use color, that the reality of your pictures is so pronounced you will feel like reaching out to touch the subjects. All of our photographic rules for taking pictures still apply with the additional factor that every composition will now have real depth, a feature of which you can take advantage with startling results. A view of trees or shrubbery, or the country lane we spoke of in an earlier chapter—many a picture which on a flat surface becomes only a jumble of details or a variety of gray tones when seen in black-and-white—will clarify itself to a scene of beauty when depicted in color stereo. You no longer have to imagine the perspective of the country lane—you can virtually walk to its end yourself; you no longer have to try to pick out the individual branches which, first seen, looked like such an attractive composition but showed up so disappointingly in your black-and-white print—each, with color stereo, stands out with definite perspective and depth.

While in straight photography you can often, whether intentionally or not, accept lack of sharpness, diffused effects or harsh lightings, only the clearest and cleanest technique will suffice for stereo. Exposure must be perfect for transparencies or prints (for mounted prints also can be used instead of transparencies in viewers similar to the old-fashioned stereoscope), and you must watch for a full tonal scale in each picture. Everything must be sharp from foreground to background. Consequently the hyperfocal distance is used most of the time to insure sharp over-all focus and, because great depth of field is essential, the narrowest aperture possible will be selected.

Stereo Projection. While most stereos are shown in hand viewers of various types, projection on a screen permits a larger audience. At the moment the best projection system available utilizes the polarization technique, by which we mean that the rays reaching the right eye are polarized in one plane and those reaching the left eye in another. To view the overlapping images, which must be thrown on an aluminum-coated screen, polarizing (3-D) spectacles are worn so that the left eye sees only the left image and the right eye only the right image, the two images focusing to produce the three-dimensional effect of depth.

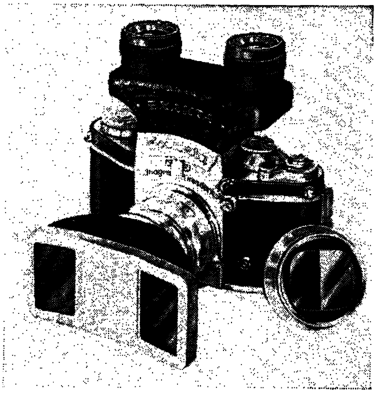
When finishing pairs of stereos, taken by either the first or second method described, which means that each will be on a full Exakta frame, the right and left images must be mounted on suitable slide material approximately 65mm apart. They can then be shown in a Realist viewer to one person at a time or can be projected for an audience through either of two double-lens projectors especially designed for stereo. One is the Realist projector which accepts only the 24x24mm Realist size. The other is the T.D.C., which will accommodate either the Realist size or the 24x30mm Verascope size.

There has also come on the market recently the Taylor table viewer for Realist slides which will go far to solve the problem of being able to show stereo to a number of persons simultaneously, without the considerably larger expense of a stereo projector and special screen, and which permits showing the slides in ordinary room light. Through an ingenious arrangement of mirrors, filters, and lenses, the image is simultaneously polarized and enlarged to about 8″, which means that as many individuals as can gather around the viewer, all of course looking at it through the 3-D polarized spectacles, can see the projected stereogram. This markedly advances stereo technique by overcoming a hurdle which has long retarded its progress. Using a single Exakta on a shift bar for still life, or two Exaktas simultaneously for action shots, you can take any desired subject, suitably mount your stereos, and, at comparatively reasonable cost, show them with this Taylor viewer to a fairly considerable audience.

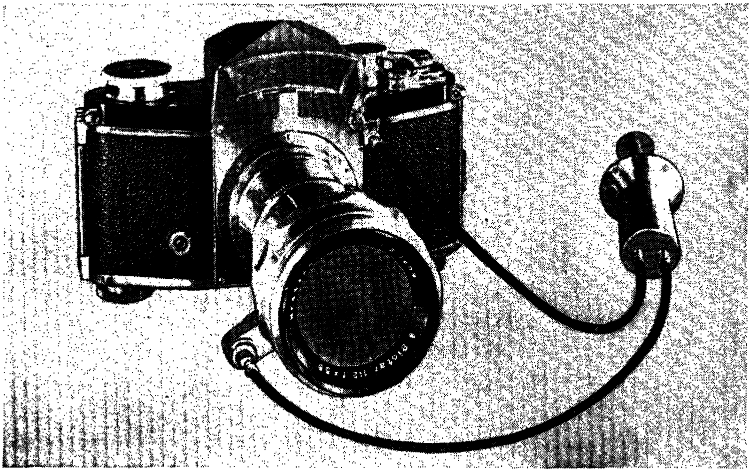
If, on the other hand, you have made your stereos by the third method explained so that you have each pair on a single Exakta frame, you can project them with little difficulty by means of any standard 2x2 projector. To do this you will require the following:

1. Standard projector with lens of 2″ focal length (or a 2″ Exakta lens specially mounted).
2. Aluminum-coated screen, or substitute of heavy cardboard covered with smooth aluminum foil.
3. One large sheet of polarizing material—a television polarizing screen without the circular pattern will do.
4. An adequate supply of 3-D polarizing spectacles.
5. Stereograms taken with the Stereo-Tach or similar device attached to your Exakta.
6. The Stereo-Tach itself.

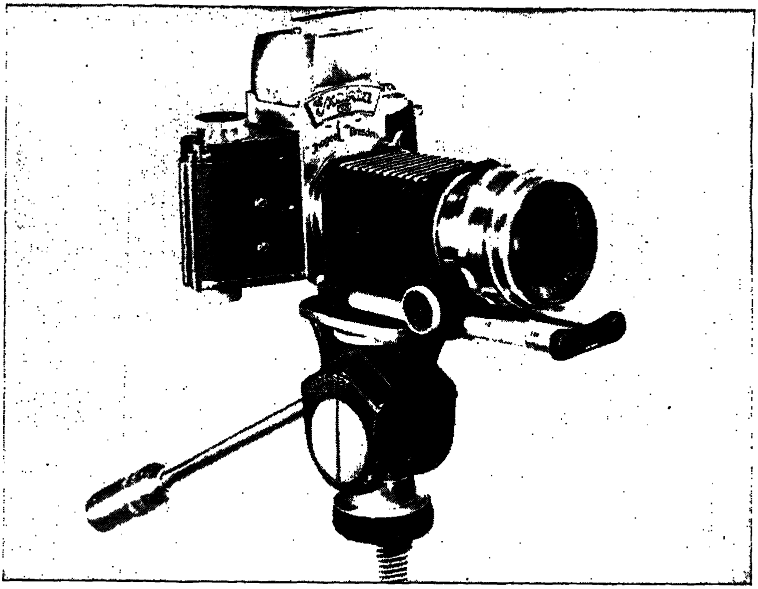
Fit the Stereo-Tach over the lens on the projector in the same manner you affixed it to the lens on your Exakta. From the sheet of polarizing material cut accurately two rectangular pieces, each to be slightly larger than either of the open ends of the Stereo-Tach. The sheet is polarized at 45° to the horizontal; so adjust the two rectangles over the two open ends of the Stereo-Tach so that they are at right angles, with respect to polarization, to each other. Now set up your screen a short distance in front of the projector, insert a slide in the projector, and turn on the light. You will see on the screen two images that overlap each other. Focus until details are sharp, but don't attempt to make the images register perfectly because they are not intended to register over each other. Put on the spectacles and if everything has been co-ordinated, you will see the images fuse into a perfect stereo picture. If not, try reversing the spectacles. If you still do not get stereo results, readjust the polarizing screens or even try reversing the slide. Once all is order and you see your picture in correct stereo effect, we advise that you mark each item of the equipment in some way so that in future you can easily reassemble it and duplicate the arrangements without difficulty.



THE IHAGEE STEREO ATTACHMENT IS A PRECISION OPTICAL DEVICE PERMITTING STEREOS TO BE TAKEN AS NEAR AS TWELVE INCHES WITHOUT DISTORTION. ANOTHER FEATURE ALLOWS YOU TO SEE THE SUBJECT IN THREE DIMENSIONS ON THE GROUND-GLASS SCREEN.



COMPLETELY AUTOMATIC DIAPHRAGMS CAN BE USED WITH EXTENSION TUBES BY MEANS OF THE CLOSAL. YOU CAN FOCUS WITH THE LENS WIDE OPEN AND THE CLOSAL WILL ACTUATE THE AUTOMATIC DIAPHRAGM SO THAT THE LENS IS STOPPED DOWN JUST BEFORE THE PICTURE IS TAKEN.



FOCUSING BAR FOR CLOSE-UPS TO SCALE WHEN CAMERA HAS TO BE MOVED SLIGHTLY WITHOUT DISTURBING THE TRIPOD.

CHAPTER 25 / PHOTOGRAPHY IN MEDICINE AND SCIENCE

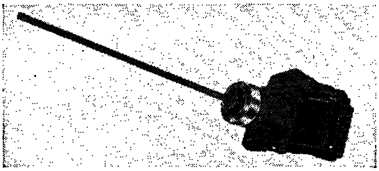
The doctor who owns an Exakta, whether he be a general practitioner or a specialist in any of medicine's many branches, will find his camera of value to him in many ways. It will simplify his record-keeping as we have already explained in the chapter on microfilming and copying, and it will also save him expensive office space which he would otherwise have to devote to cumbersome files. His records of X-rays, diet charts, fever charts, and the like can be thus compressed into almost unbelievably small space. If he teaches or lectures, he can greatly broaden the scope of his activities by means of Exakta slides made at small expense. And his continuing studies, which no physician can ever neglect, can be expanded because portions of reference works, often available to him for only a short time, can be quickly microfilmed for study when time permits.

Dermatology. Particularly is 35mm photography a boon to the dermatologist, because color transparencies on Kodachrome or Ansco Color film, inexpensively taken with the Exakta, are excellent for

DENTAL CAST

← EXERCISE SANDAL

AN UNUSUAL CASE



DOCTORS CAN PHOTOGRAPH THE INNER ORGANS OF THE HUMAN BODY WITH THE ENDOSCOPIC ATTACHMENT.

recognition purposes. Normal description of skin conditions narrows itself down to the use of some twenty or thirty common words. Considering their similarity, the practitioner finds that after a while all skin manifestations begin to sound more or less alike when verbally described. With a color transparency at hand, only the general case history is necessary, because such a picture speaks for itself, and many an unusual skin disease has been satisfactorily diagnosed merely through sending a slide to some distant consultant. In medicine, certainly, "one picture is worth ten thousand words."

The Reprox 12, or an extension tube set-up, is excellent for photographing skin conditions with the Exakta, as the illustration indicates. The only two problems are those of adequate illumination and proper control of movement. You know that the closer you approach your subject, the shallower is your depth of field. To overcome this, the lens must be stopped to its narrower openings. For work of this nature we advise the use of photofloods in 5″ spot reflectors, co-ordinated by means of a Hi-Lo switch.

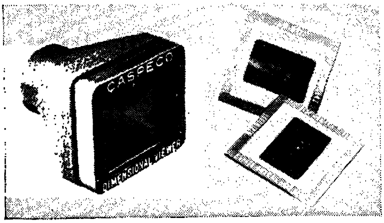
Your lights, of course, must be close to the subject, which means, if you are burning photofloods for any length of time, unpleasant if not even painful heat for the patient. With one of these hand Hi-Lo switches you have adequate light for focusing and need only turn on

THE FR TABLE VIEWER IN USE FOR PATIENT DEMONSTRATION

the full intensity of the lights for a short period. The chief source of movement when making most such pictures will be the breathing of the patient or, in some cases, the pulse beat, but at a speed of $1/25$ second both will be under control. The correct color temperature of the lights, however, is extremely important in medical photography where often the color of a subject or specimen may alone be sufficient to determine the diagnosis.

Where photographs must be made in the operating room, the Exakta, with telephoto lenses and, of course, used on a tripod, offers several advantages, not the least of which are its small size and compactness. The bright light under which the surgeon works will often be sufficient plus, probably, one powerful spot. With a roll of 36 exposures in the camera and its quick winding feature to help, an ample series of sequence shots can be made—and at little cost even when working in color. With the latter, it should go without saying that the color temperature of the light must again be considered, and it may be necessary to substitute suitable Kelvin lamps for those normally used in the room with, if a spot is added, a lamp of the same Kelvin temperature in that.

Dental Work. Dental work, too, has problems all its own. Many dentists find it advisable to photograph the full-mouth Plaster-of-Paris casts they make of their patients, for a permanent record. Such casts, being all white, represent mainly a problem in correct lighting. If we are to make a satisfactory picture of such a white cast, which will of course reflect 90 per cent of the light thrown on it, we must



THE CASPECO MAGNIFIES THE SLIDE
WHILE VIEWING.

use a very weak, diffused light, and that from equally placed 60-watt bulbs has been found most suitable. The same 5″ spot reflectors that we mentioned earlier will do very well for the purpose. They are moved horizontally into position toward the cast, but with the reflectors angled away from the cast so that only the light reflected from the rim or edge of each reflector strikes the cast, a style of lighting which the professional photographer calls "feathering" the light. Because the light must be evenly balanced from both sides, two reflectors are necessary.

The lights correctly placed, still another problem remains: the fact that the emulsion is generally over-sensitive to blue. Unless some step is taken to correct this, in the resulting picture the whites will be clogged and there will be difficulty in distinguishing the important outlines of gums and teeth. One way of assuring some tonal difference between the various sections of such an all-white cast is to use an orange filter over the lens, but without multiplying by the normal filter factor when calculating the exposure. This will result in an intentional under-exposure which will yield a thin negative when developed in a fine-grain formula such as D-23, yet a negative which, when projected on a contrasty paper, will provide a print with all the desired detail.

In podiatric work, also, the Exakta can record for the practitioner the treatment of an ingrown nail, the gradual correction of posture through proper exercises, and even gait correction by means of proper shoes. The first is purely a matter of straight photography. To secure records of posture improvement over a period of time it is a simple matter to mark off a chart on any appropriate white or light wall in the doctor's office. The wall should be plainly ruled off in inches for a horizontal distance of 3′ and a height of 7′. The patient need then only be placed against the wall long enough to take three photographs: side view, front view, and back view. A series of such pictures, taken at appropriate intervals, becomes not only a perfect record for the doctor but, as the treatment begins to indicate real progress, a wonderful psychological stimulant for the patient. And. returning for a moment to dentistry, orthodontists who have difficulties with teen-agers whose teeth must remain for some length of time in braces, can reduce their often voluble complaints materially if from time to time the young patients can be shown pictures which graphically prove that their teeth are looking better.

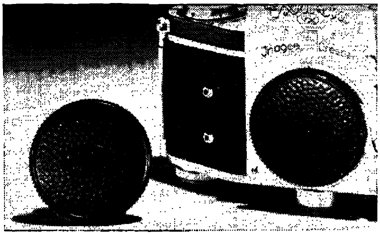
But medicine, though we have devoted considerable space to it is not the only profession or occupation which can benefit through the utilization of 35mm photography with the Exakta. Architects, engineers, and contractors can record the progress, in pictures, of a building, bridge, or any other structure for their files. The architect, also often faced with the problem of limited office space, can microfilm his blue prints after each assignment is completed and thus have them always ready for quick reference without the necessity of storing what, in the case of a large project, may well run into half a ton of paper. As a helpful note, we suggest using a red filter to increase the contrast.

In the case of a large corporation, while a building or project cannot well be moved around the country for the members of a widespread board of directors to inspect and approve, for branch managers to look at, or for salesmen to see so that they can discuss it intelligently with their customers and prospects, with the Exakta it is no trick to provide photographs or even a complete history in album or slide form. Production men, too, can make time studies of different phases of manufacture and processing. Accountants, statisticians, economists, the members of practically any profession, industry, or group will find photography a material supplement to any type of recording. For all such purposes the Exakta, easy and quick to operate, small enough to stick in any spare corner of one's luggage, and light and compact enough to be no burden when carried, is ideal.

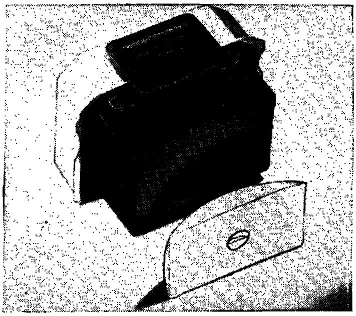
Sketchy though these few suggestions necessarily are, they should serve to indicate that the owner of an Exakta is fortunate in having at his disposal a precision instrument which, though it may initially have been purchased solely for hobby purposes, can become an invaluable tool when applied for more utilitarian activities. Consider your Exakta carefully in the light of your daily work and you will find that in many ways it can save you both time and money.

CHAPTER 26 / ACCESSORIES FOR THE EXAKTA

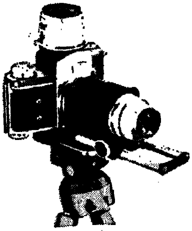
On the following pages we illustrate and briefly describe a selection from the numerous accessories and lenses which have been specially designed for use with the Exaktas. Some of these are virtual essentials for any type of serious work; others will find their place only in the outfits or darkrooms of specialists in certain types of photography. In any event, to secure the best results with any make of camera, it is well to choose accessories made by Ihagee as official equipment, or by reputable firms.



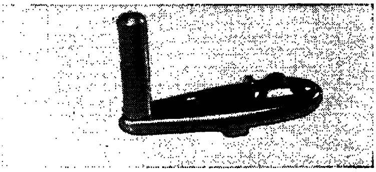
A LENS CAP KEEPS THE LENS FREE FROM DUST AND DIRT.



THE SPLIT-IMAGE RANGEFINDER GROUND-GLASS CAN REPLACE THE STANDARD MODEL.

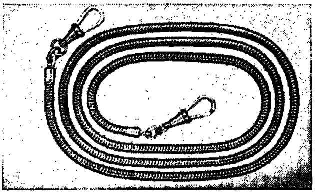


THE MAGNEAR HELPS SHARP FOCUSING FOR CLOSE-UP PHOTOGRAPHY.



THE RAPID REWIND (FOR EARLIER MODELS).

THE SPECIAL VIEWFINDER EYE-CUP FOR THE PENTA PRISM. PREVENTS EYE GLARE.



A METAL SNAKE-CHAIN SHOULD BE USED WHENEVER THE CAMERA IS USED OUTSIDE THE CASE.

CONTINUOUS FOCUSING ASSEMBLY

Bellows extension for Exakta (single carriage) with f/4.5, 105-mm coated Steinheil lens

Bellows extension for Exakta (double carriage) with f/4.5, 105-mm coated Steinheil lens

Bellows extension for Exakta (double carriage) with f/4.5, 135-mm. coated Schneider Xenar lens

Continuous Focusing Assembly for close-ups at a distance consisting of Bellows extension (double carriage) with f/5.5, 400-mm. coated Hugo Meyer Goerlitz Tele-Megor lens

MISCELLANEOUS ACCESSORIES

Scientific waist-level reflex viewfinder for Exakta V and VX with special focusing glass
- With ground glass with center cross
- With clear glass with center cross
- With ground glass with clear center spot and hairline center cross

Leather case for viewfinders

Special scientific focusing glasses for Penta Prism Viewfinder:
- Ground glass with center cross
- Clear glass with center cross
- Ground glass with clear center spot and hairline center cross

Ihagee set of 3 extension tubes and 2 adapters

Ihagee Two-in-one adapter for extremely short extension

Ihagee Type I hinged microscope adapter, complete set, with 2 extension tubes

Ihagee Type II two-piece pressure microscope adapter, with 2 extension tubes.

Camera Clamp—fastens to round or flat object for vertical or horizontal positioning.

"Elektra" Remote Control attachment, releases shutter at moment desired

Flashgun for Exakta, B.C. Capacitor

Safety Intermediate Plug, for use with other flashguns

Cable release

Reflex focusing hood

Ihagee Rewind Lever (for Models I, II and V)

Ihagee Giant Release Knob (for all models)

Dust Cap, for Exakta Camera Body

Flexible metal neckstrap, chrome plated

Exakta lens holding mount for enlargers

S.W. Universal Cassette, permits use of 35-mm bulk film

Pullin Prismatic Rangefinder, facilitates indoor flash photography

SPECIAL SCIENTIFIC VIEWFINDER

Magnear Viewfinder with regular ground glass

Focusing glass with center spot and hairline.

Magnear Viewfinder with regular ground glass and Zeiss Tessar 50-mm., non pre-set f/3.5 coated lens for critical focusing

Zeiss Tellup Telescopic Magnifier for additional magnification up to 15X

ADAPTERS, SUNSHADES, FILTERS

Filter adapters‡ (screw-in):
- Series V for 2.8 and 3.5 Tessar, 2.0 Xenon, 2.8 Trioplan (100-mm.)
- Series VI for 2.8 and 3.5 Tessar pre-set, 2.8 Westanar automatic, 1.9 Xenon automatic, 4.5 Tessar, 4.5 Helioplan, 3.5 Cassaron, 2.8 Culminar, 2.5 Angenieux (Y-1), 3.5 Angenieux (Y-2), 4.0 Triotar, 4.5 Culminar, 5.5 Tele-Megor (150-mm.), 2.8 Westar, 2.0 Westagon automatic
- Series VII for 1.5 and 1.8 Angenieux (S-21 and P-1), 1.9 Primoplan (58-mm. and 75-mm.) 2.0 Biotar pre-set, 2.8 Quinar, 5.5 Tele-Megor (250-mm.) 2.0 Biotar automatic, 1.5 Biotar (75-mm.), 4.5 Quinar.
- Series VIII for 2.5 Angenieux (R-1 and P-2).
- Series IX for 3.5 Angenieux (R-11), 5.5 Tele-Megor (400-mm.)

SUNSHADES: (Must be used with filter adapter above)
- Series V
- Series VI
- Series VII
- Series VIII
- Series IX
- Series VIII-WA—(Wide Angle)
- Series IX-WA—(Wide Angle)

STEP-UP RINGS:
- Series V to VI
- Series VI to VII
- Series VII to VIII
- Series VIII to IX

FILTERS:
- Series V
- Series VI
- Series VII
- Series VIII
- Series IX

Zeiss Screw-in Filters for Tessar f/3.5 and Tessar f/2.8 pre-set lenses — available in orange, light green, medium green and dark green
(when sunshade is required, use 42-mm. standard slip-on type)

FILTERSETS, 4 filters with screw-in adapter and sunshade:
with genuine leather top-grain cowhide filter case
- Series V
- Series VI
- Series VII

‡Please specify lens when ordering adapter.

VIEWFINDER ACCESSORIES

Penta Prism eye-level prismatic viewfinder with split-image rangefinder
Penta Prism eye-level prismatic viewfinder
Split-image rangefinder glass only (to fit Penta Prism Finder)
Eyepiece for Penta Prism viewfinder
Waist-level reflex viewfinder
Leather case for Penta Prism viewfinder or waist-level reflex viewfinder

AUTOMATIC LENSES, COATED

f/1.9, 50-mm Schneider Xenon, fully automatic lens
f/2.0, 50-mm. Westagon, fully automatic lens
f/2.8, 50-mm Westanar, fully automatic lens

HIGH SPEED LENSES, COATED

f/1.5, 50-mm. Angenieux Type S21, pre-set diaphragm
f/1.5, 75-mm. Zeiss Biotar, pre-set diaphragm
f/1 9, 75-mm. Hugo Meyer Goerlitz Primoplan, pre-set diaphragm
f/1.8, 90-mm. Angenieux Type P1

COPYSTAND OPTICAL BENCH SYSTEM

CopyMat, optical bench system copystand, complete with accessories
  Model 1
  Model 2

VERSAL ASSEMBLY (AND PARTS)

Baseboard Metal Postal Arrangement
Sliding Arm with Calibrated Scale
Bellows Extension
Rotating Angle Bracket Assembly
Transparency Copying Attachment
**Ring for attaching camera lens to Transparency Copying Attachment
Light-trap Tube for Photomicrography

Versal Assembly Complete Outfit

BELLOWS EXTENSION APPARATUS

Bellows extension for Exakta (single carriage)
Bellows extension for Exakta (double carriage)
Tripod Rack for use with single carriage
Leather carrying case for either single or double carriage
f/4.5, 105-mm. coated Steinheil lens, to fit single or double carriage bellows extension
f/4.5, 135-mm coated Steinheil lens to fit single or double carriage bellows extension
Adapter for front part of 135-mm. Steinheil Culminar so it can be used for bellows extensions

**Specify lens when ordering

UNIVERSAL LIBRARY

124 292

UNIVERSAL LIBRARY